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SCATTERING LAYER OBSERVATIONS MADE DURING PROJECT EARS CRUISE I--ETC(U)
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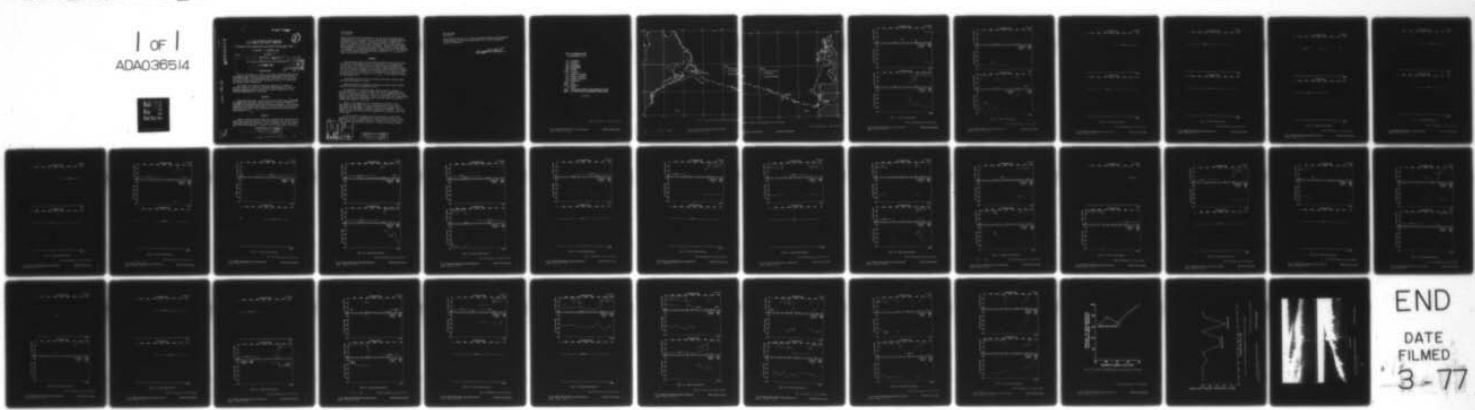
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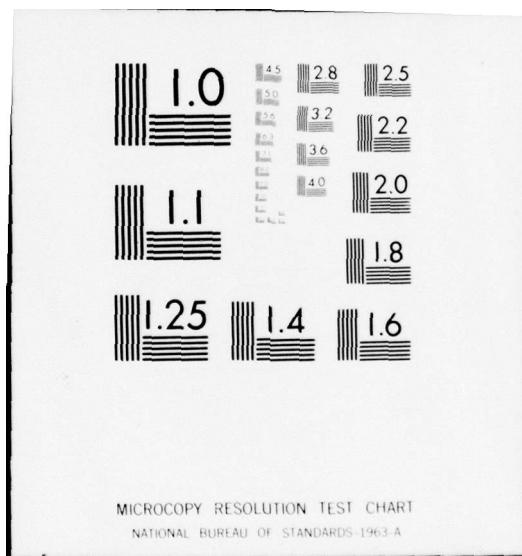
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6 U. S. NAVY UNDERWATER SOUND LABORATORY
FORT TRUMBULL, NEW LONDON, CONNECTICUT

SCATTERING LAYER OBSERVATIONS MADE DURING PROJECT EARS CRUISE I

28 OCTOBER - 13 DECEMBER 1966.

9 by Donald

10 D. A. Hull

11 USL-TM-

12 DDC

13 USL Technical Memorandum No. 2211-106-67

14 18 September 1967

15 MAR 7 1977

16 1239P.

17 INTRODUCTION

18 1977

20 D

This is the fourth in a series of technical memoranda dealing with environmental data obtained during Project EARS Cruise I (28 October-13 December 1966). This memorandum deals specifically with the observations of scattering layers made during the cruise at 12.0 KHz with the standard ship's fathometer.

The results of biological sampling conducted at a number of locations along the track, are presently being analyzed in order to identify organisms present, and will be reported separately in USL Technical Memorandum No. 2213-177-67.

21 ANALYSIS

22 Continuous PDR traces were obtained by both AGOR ships, USNS SANDS and LYNCH, while underway. These records were visually scanned for incidence of scattering layers and the results tabulated. This listing summarizes the presence and movement of all scattering layers along the track with date, time of day, geographical position, water depth and meteorological data.

23 RESULTS

24 Figure 1 shows the cruise track and indicates both the sunrise and sunset ship positions when the PDR's were operating and whether or not scattering layers were observed. Table 1 provides a key to the symbols used in the following plots. Figures 2-31 are daily graphs showing in

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detail the positions and behavior of the observed scattering layers. Bottom depths are shown where layers were observed. Weather and other pertinent data are included. Periods during which no layers were noted are included in this group of figures since, in this particular study, negative results are also significant. Figures 32 and 33 give the percentage of recording times that layers were seen plotted against 4° increments of latitude and longitude. Figures 34 a & b are excerpts from the PDR illustrating typical diurnal migration; i.e., ascent at sunset and descent at sunrise.

COMMENTS

No scattering layers were seen when the water depth was less than 100 fathoms. Also during periods of storm such as were encountered off the coast of Portugal (vicinity of Galacia Bank) and again just east of the Azores, no layers were observed. Under conditions of high sea state, abnormal turbulence at the fathometer head reduces the signal to noise ratio, so the absence of a recorded layer at such times does not necessarily deny the existence of a layer. It may simply be masked by extraneous noise.

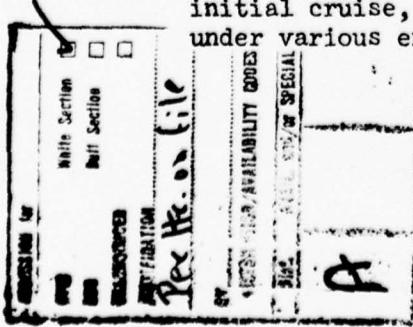
In general, the usual close correlation between the moving layer and sunset and sunrise is found.

Multiple layers are frequently observed, and some rather complex patterns are seen as in Figures 15-27-28.

No dependence of scattering layer observations on longitude is obvious (Fig. 33). It should be noted that the two regions where the percent of observations falls to 50% or less correspond to periods when high sea states were encountered. Again, no cause and effect relationship between sea state and scattering layer occurrence should be inferred despite the apparent correlation.

There is some suggestion of a dependence on latitude in the percentage of measurements in which scattering layers were observed (Fig. 32), but the range of latitude covered and the volume of data available are insufficient to permit a conclusive statement. Here the single low value at 40° N is heavily weighted by the high sea state data off Portugal.

It is desirable to continue these observations in future EARS operations in order to supplement the limited latitude spread of this initial cruise, to re-examine specific localities at other seasons and under various environmental conditions. Because the present results



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represent the findings at a single (convient) frequency, investigation
of the response of the scattering population to other frequencies
should be considered.

Donald A. Hull
D. A. HULL

KEY TO SYMBOLS USED
IN FIGURES 2 TO 36

SR - SUNRISE
SS - SUNSET
MR - MOONRISE
MS - MOONSET
CLR - CLEAR
CLDY - CLOUDY
LC - LIGHTY CLOUDY
PC - PARTLY CLOUDY
MC - MOSTLY CLOUDY
OC - OVERCAST
FOG - FOG
DRZL - DRIZZLE
R - RAIN
// - VERY DARK AREA OF SCATTERING AT TOP
OF TRACE BUT NO DEFINATE LAYER SEEN

TABLE I

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NP24 - 31568 - 10 - 67

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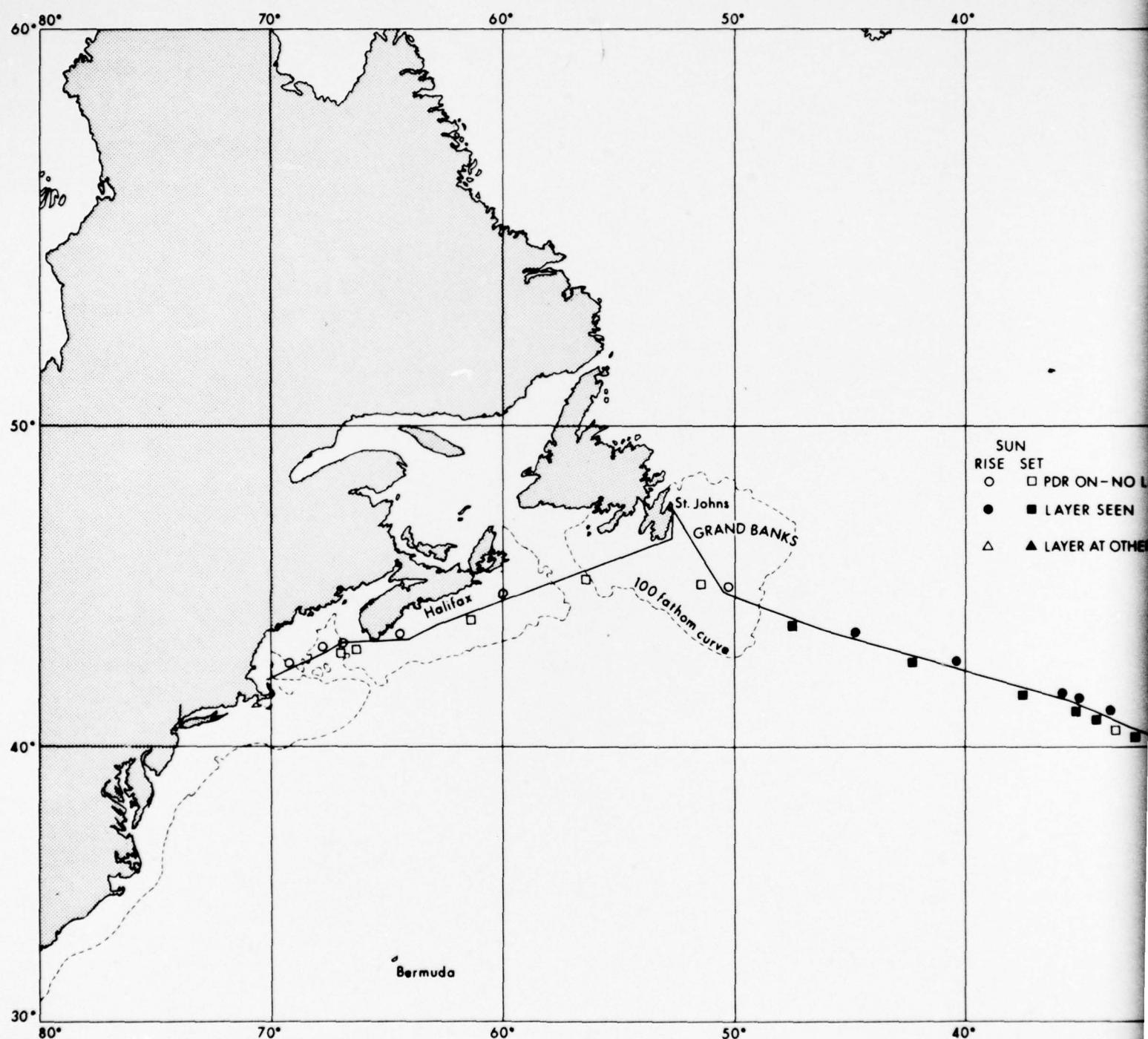
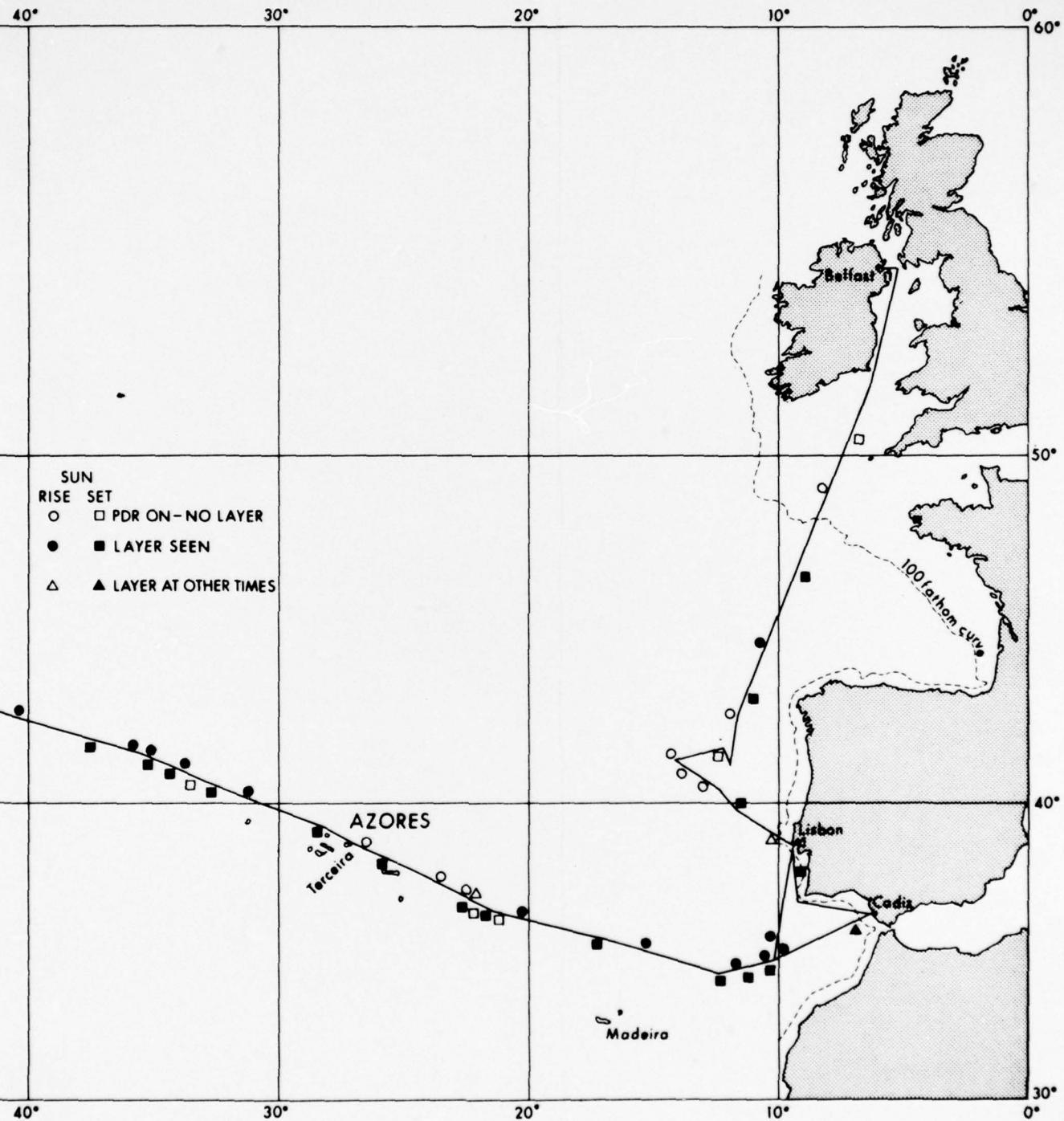


Fig. 1 - Cruise Track - Scattering Layer O

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ruise Track - Scattering Layer Observations

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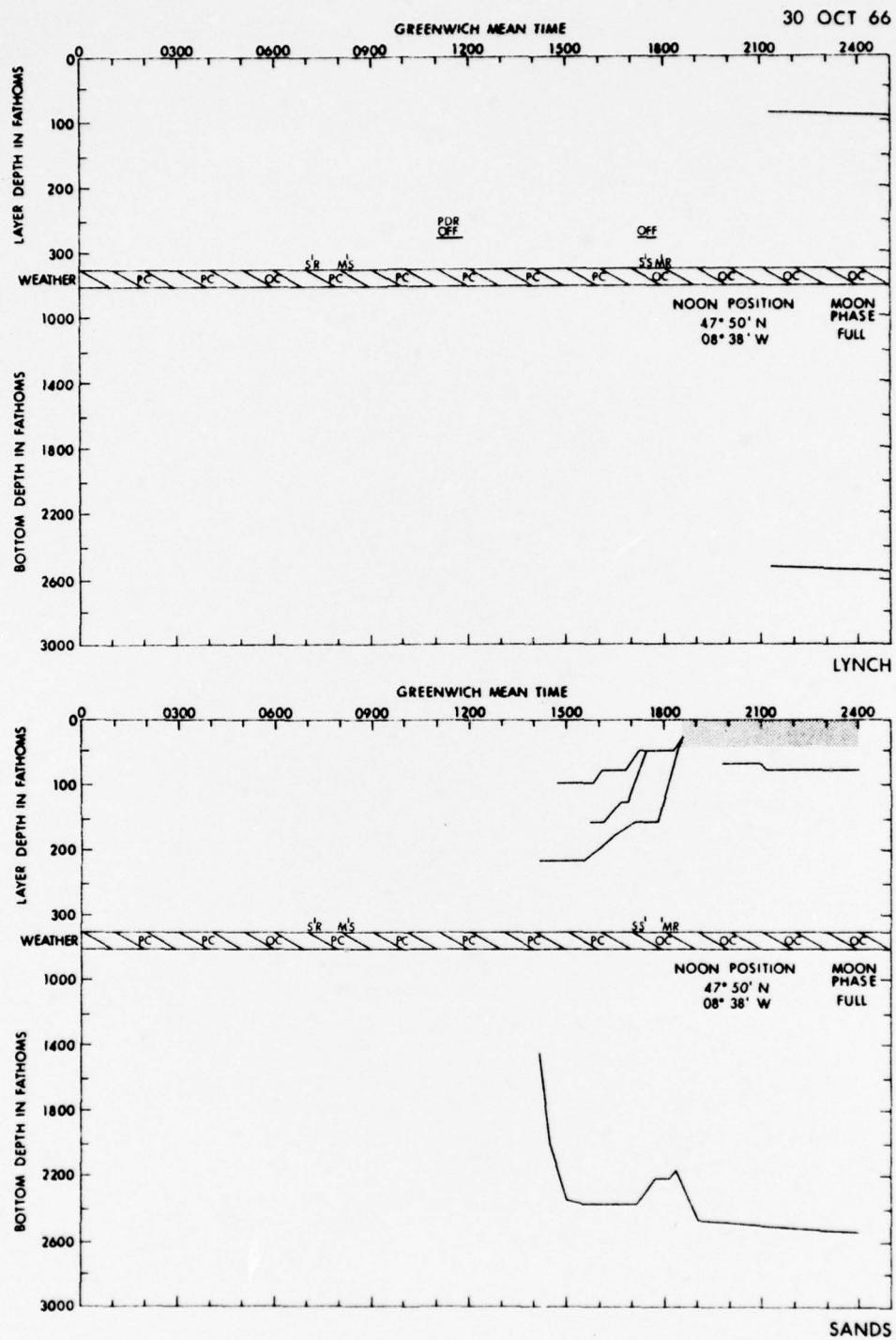


Fig. 2 - Daily Observations

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Official Photograph

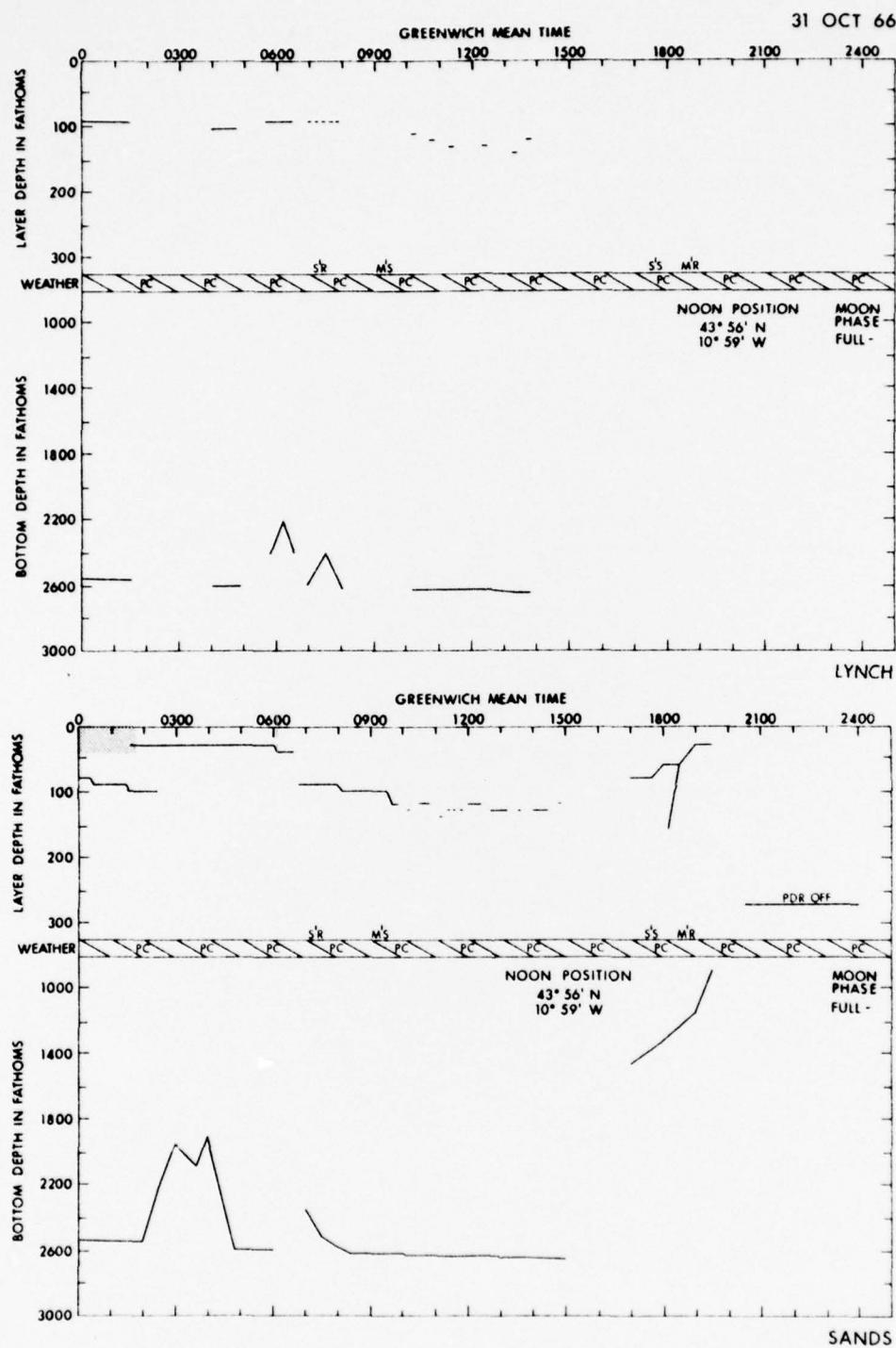


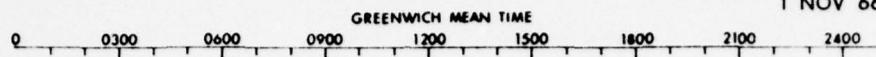
Fig. 3 - Daily Observations

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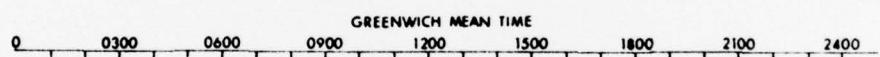
Official Photograph

1 NOV 66



PDR OFF

LYNCH



PDR OFF

SANDS

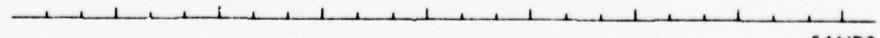
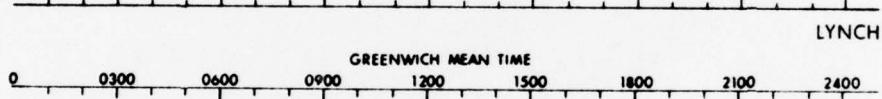
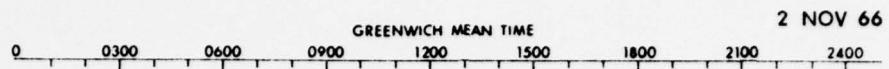


Fig. 4 - Daily Observations

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This block contains a horizontal timeline for the day of November 2, 1966. The scale is labeled 'GREENWICH MEAN TIME' and ranges from 0 to 2400 in increments of 300. Below the scale, the text 'PDR OFF' is centered above a short horizontal line.

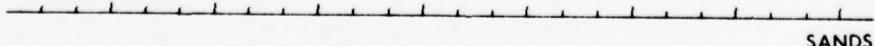


Fig. 5 - Daily Observations

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Official Photograph

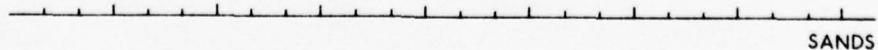
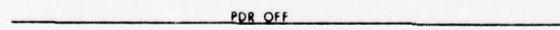
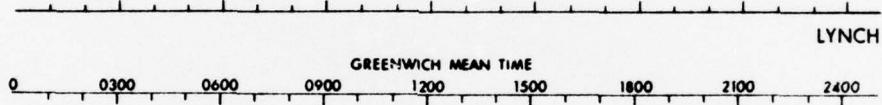
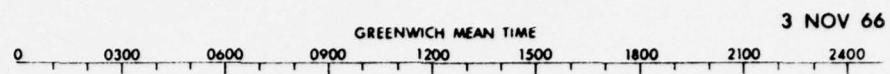
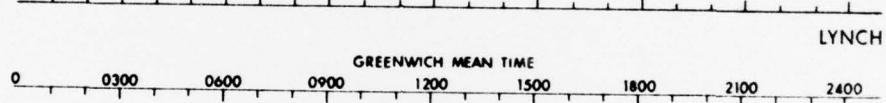
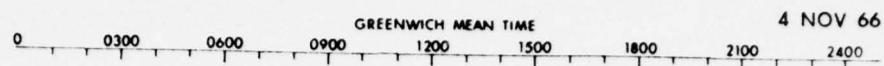


Fig. 6 - Daily Observations

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U. S. Navy Underwater Sound Laboratory
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Official Photograph



PDR OFF



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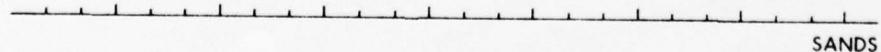


Fig. 7 - Daily Observations

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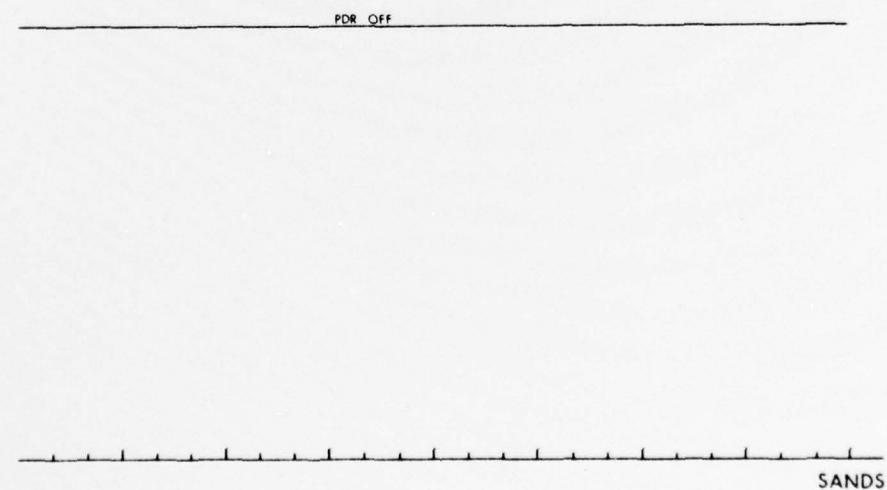
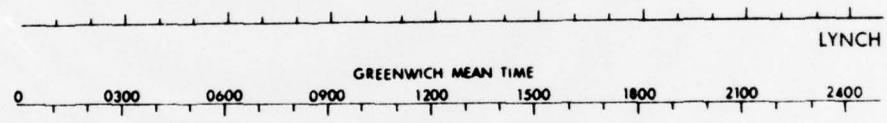
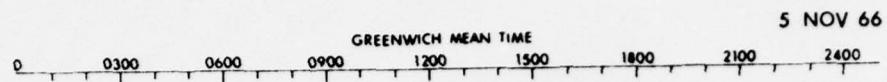


Fig. 8 - Daily Observations

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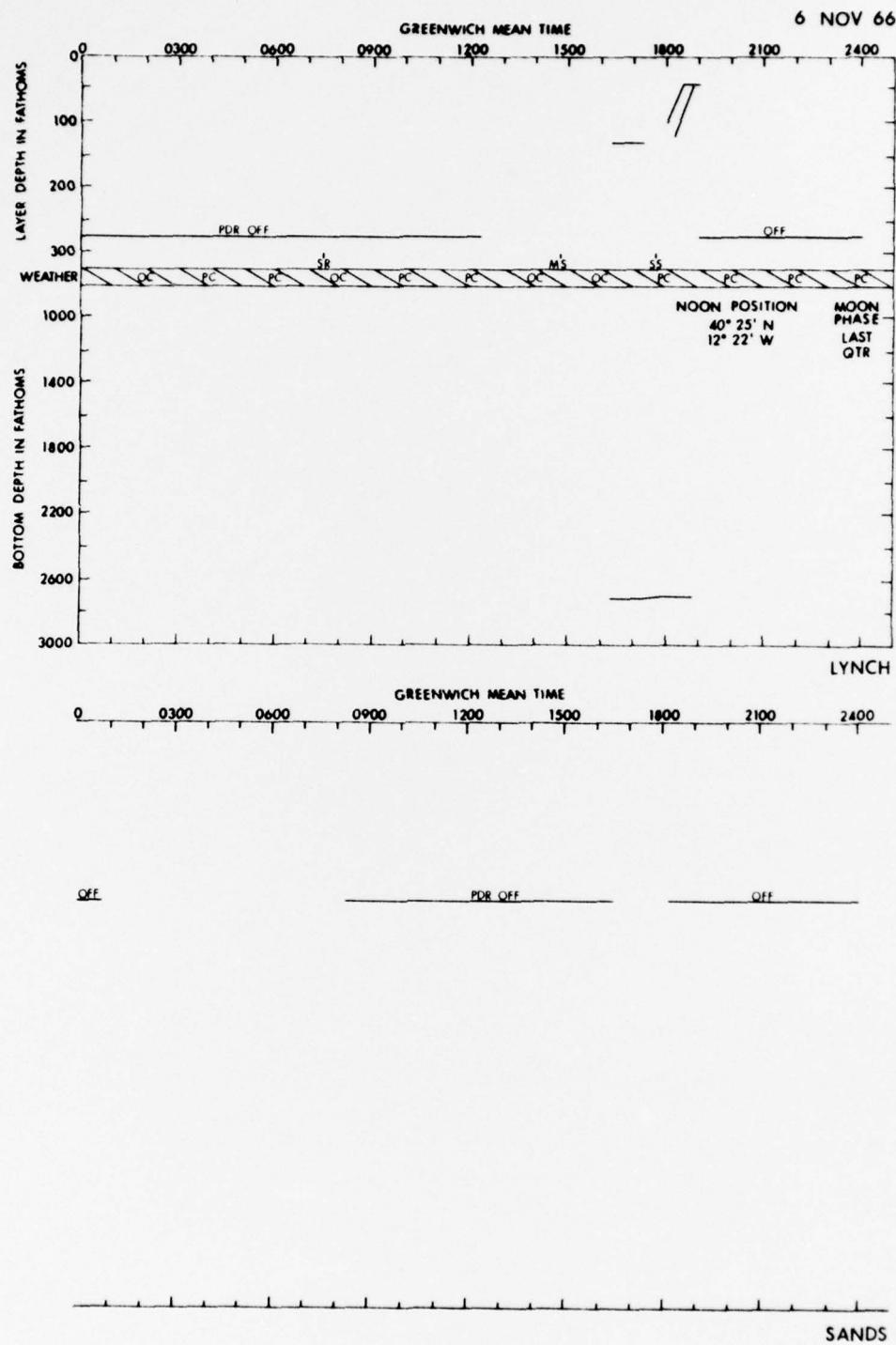


Fig. 9 - Daily Observations

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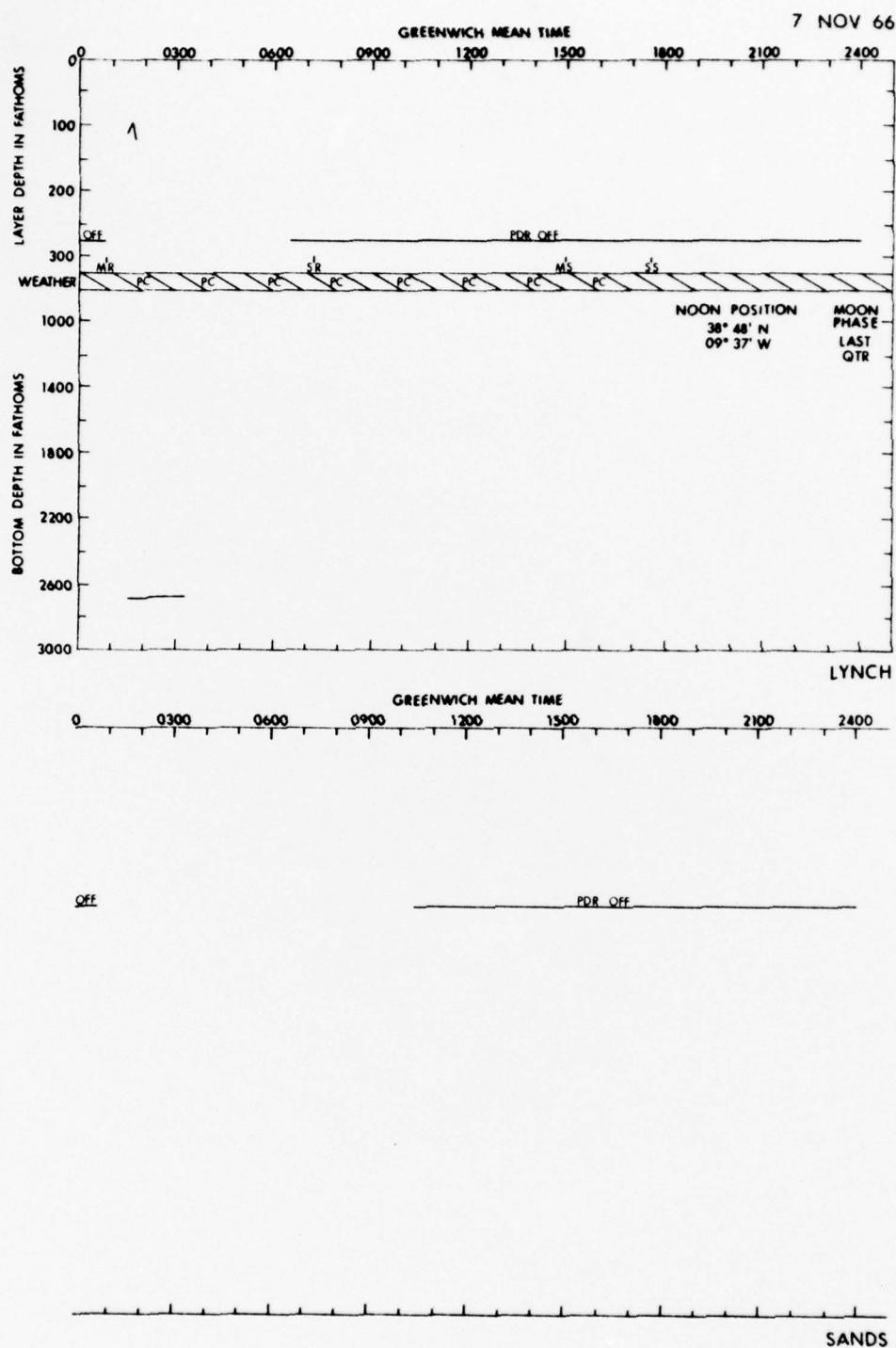


Fig. 10 - Daily Observations

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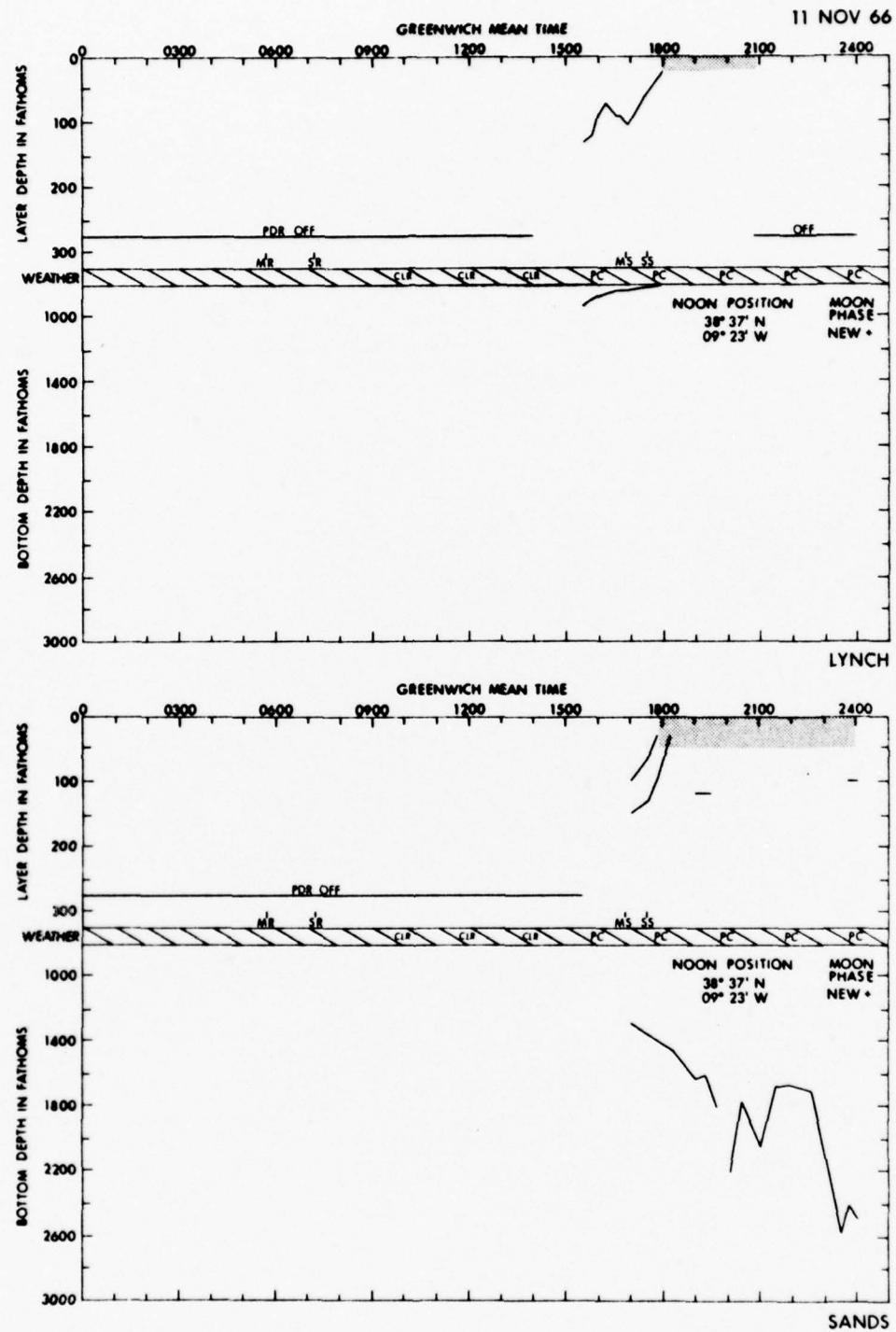


Fig. 11 - Daily Observations

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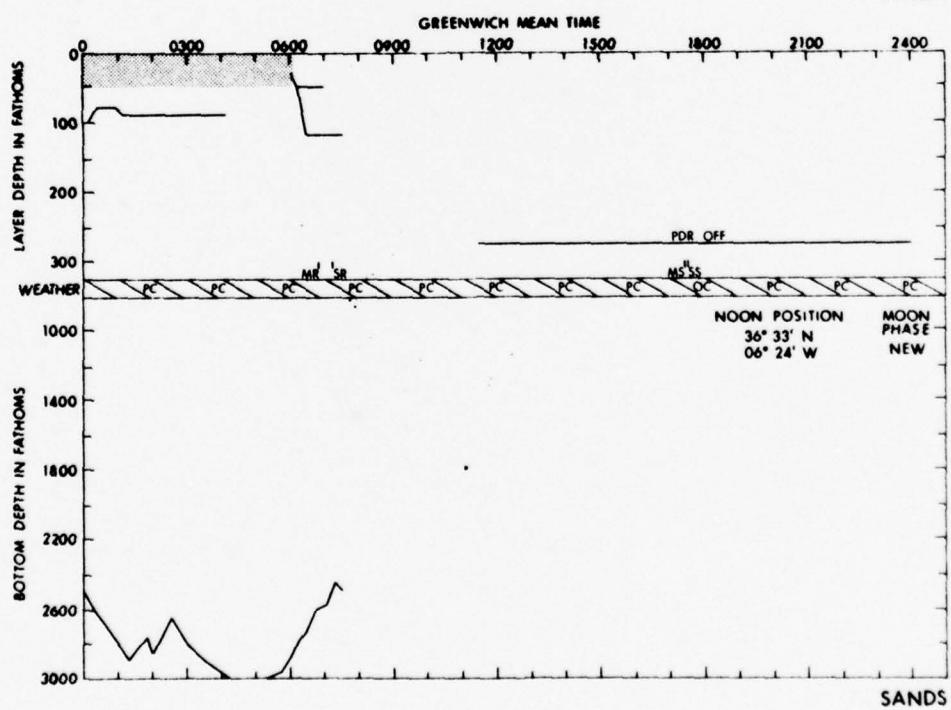
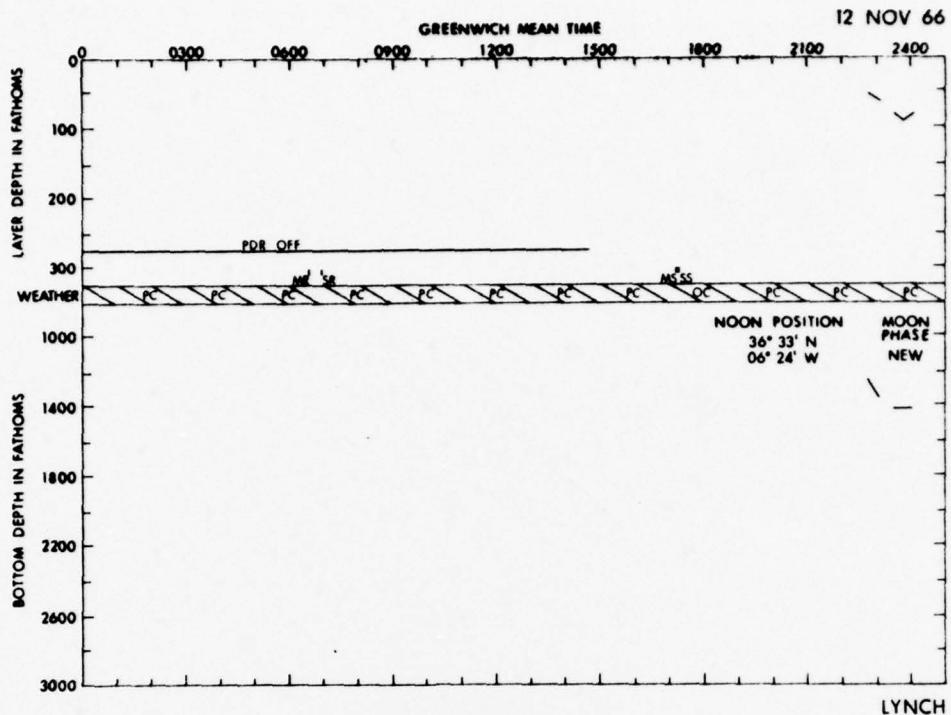


Fig. 12 - Daily Observations

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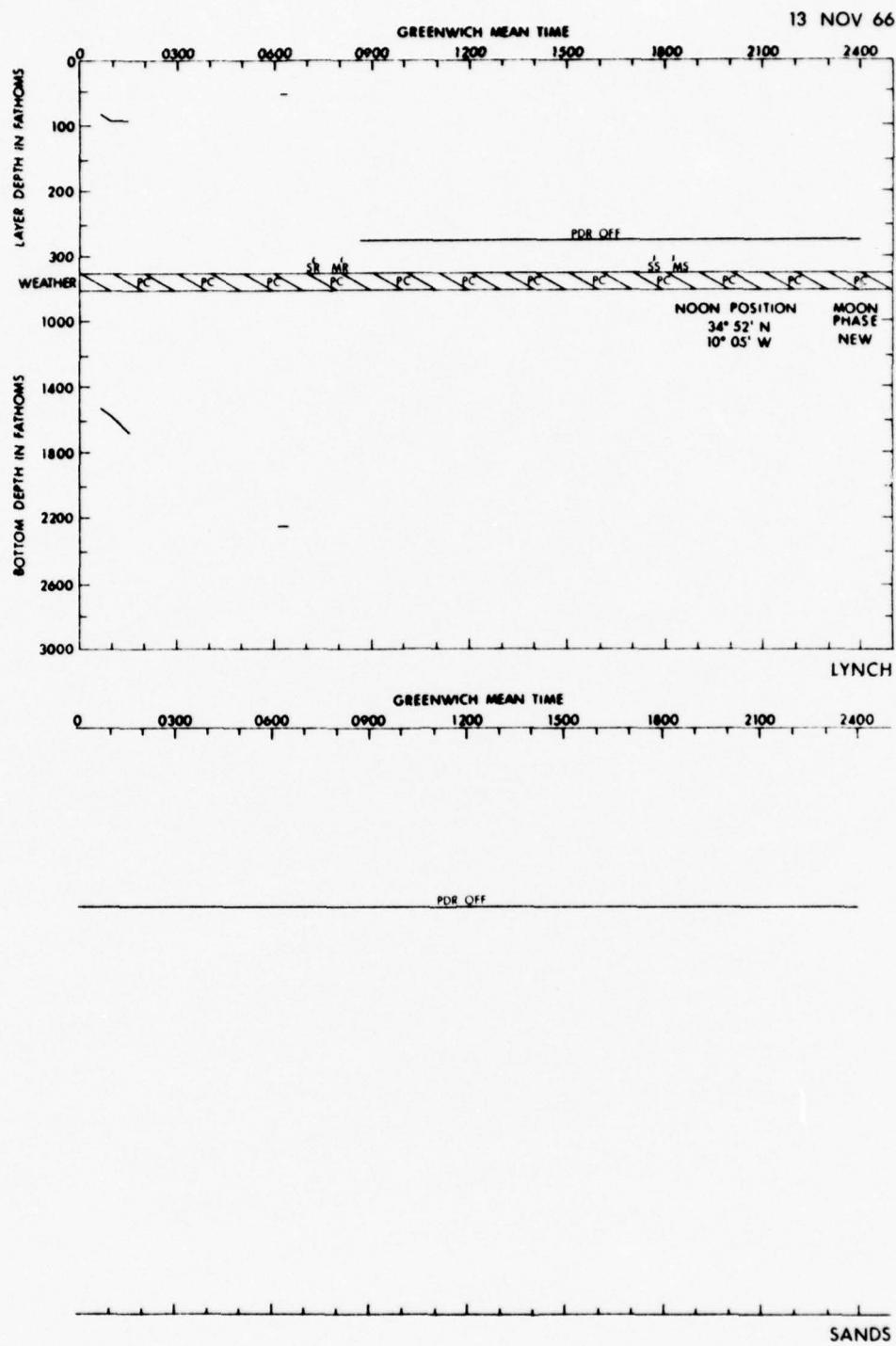


Fig. 13 - Daily Observations

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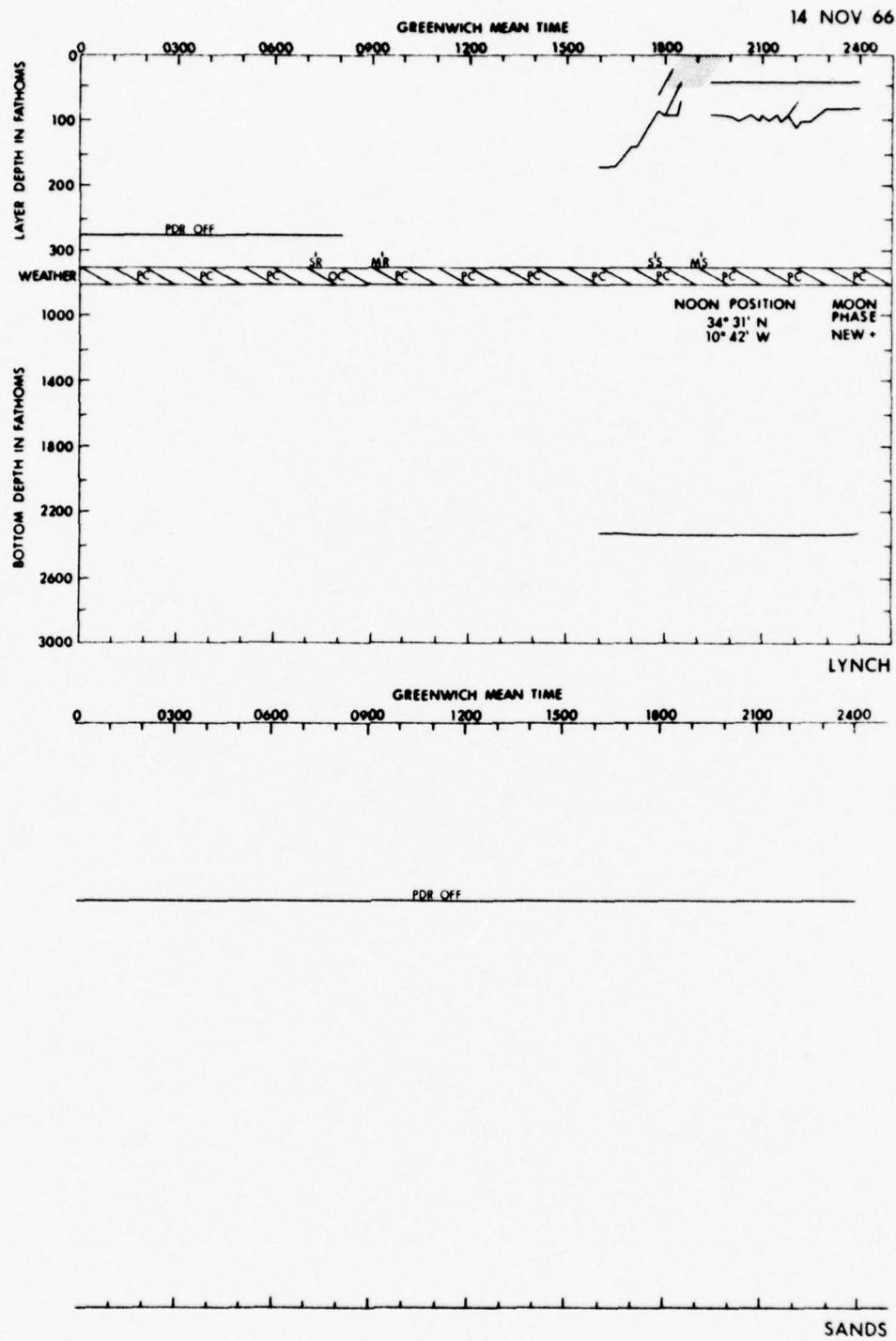


Fig. 14 - Daily Observations

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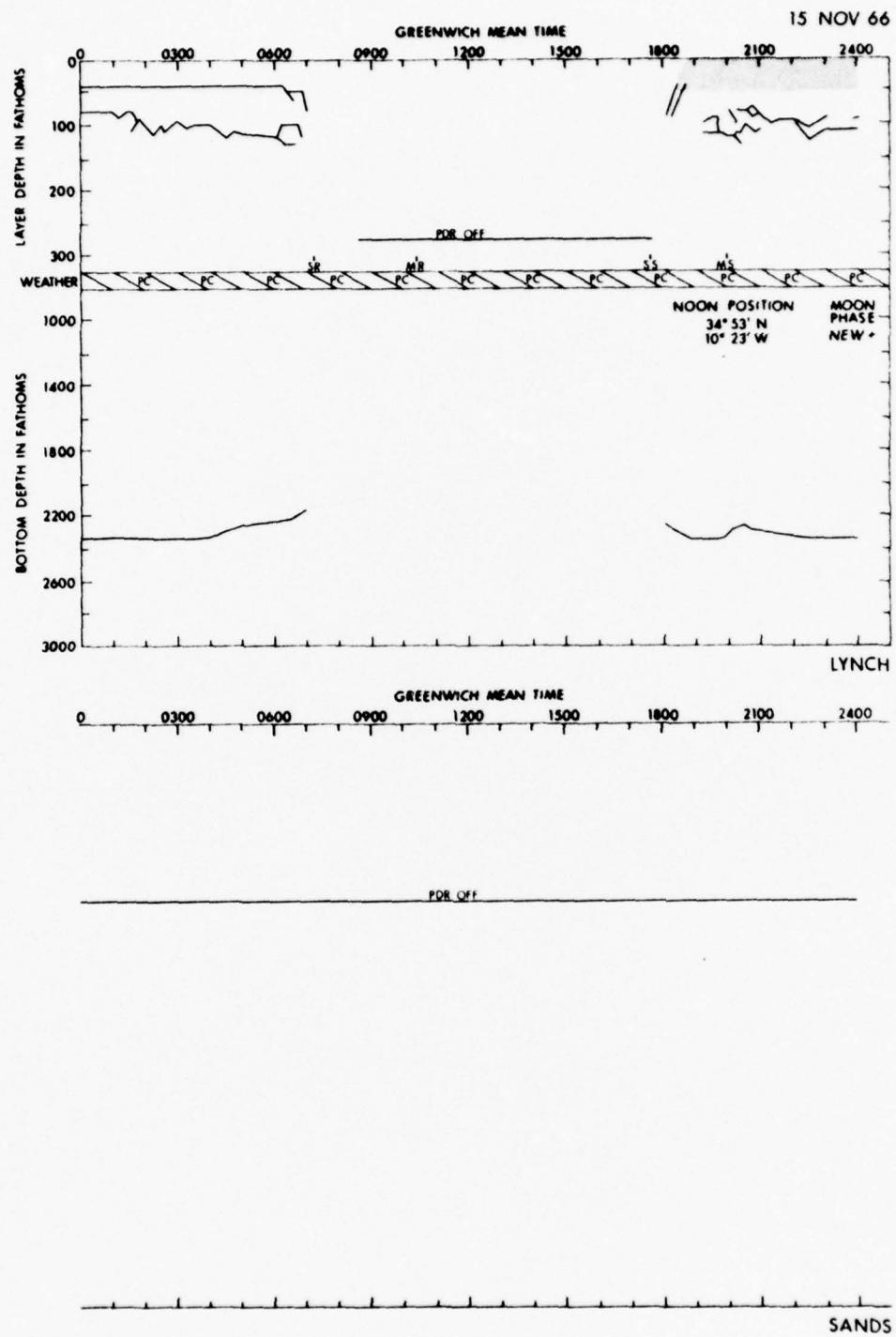


Fig. 15 - Daily Observations

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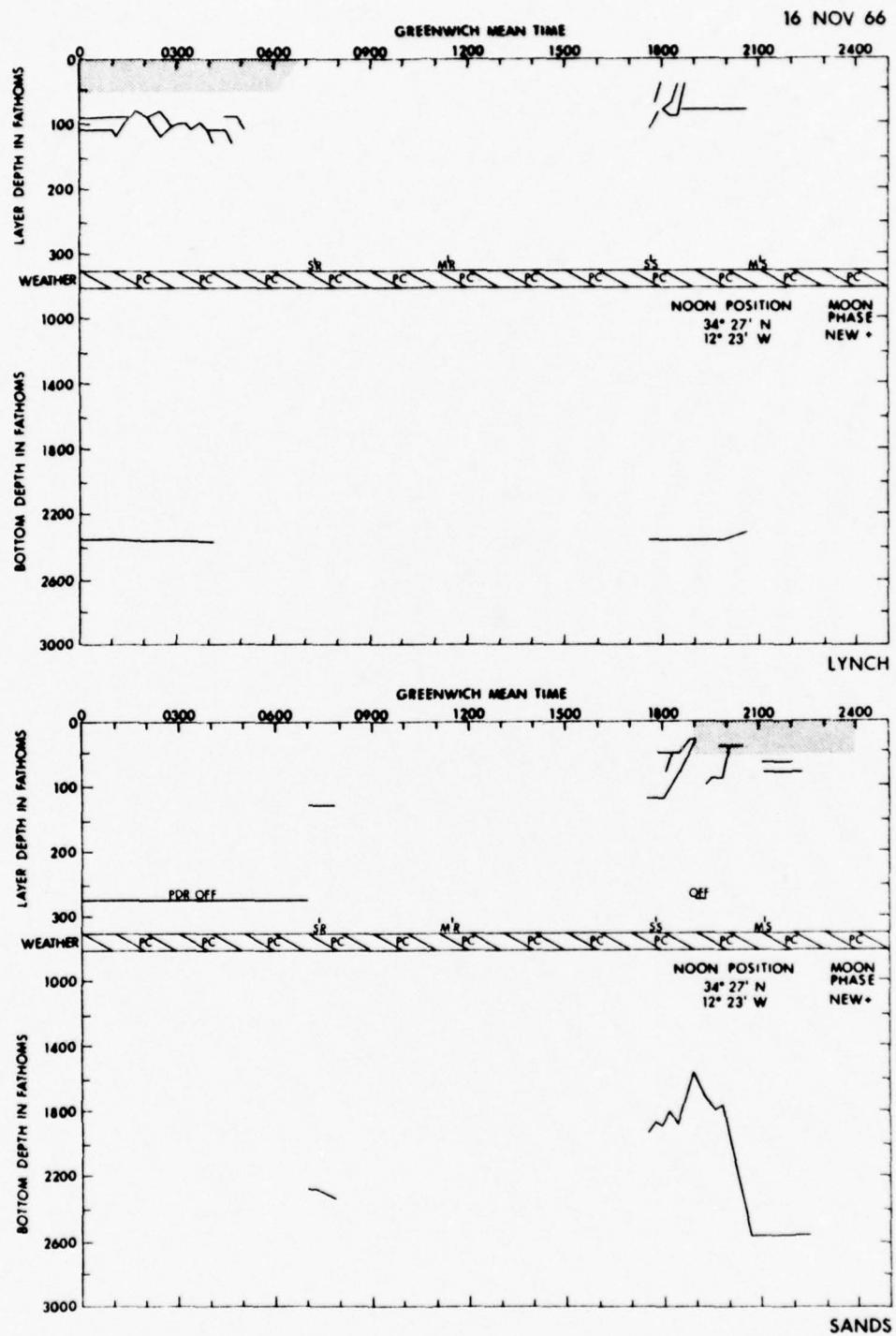


Fig. 16 - Daily Observations

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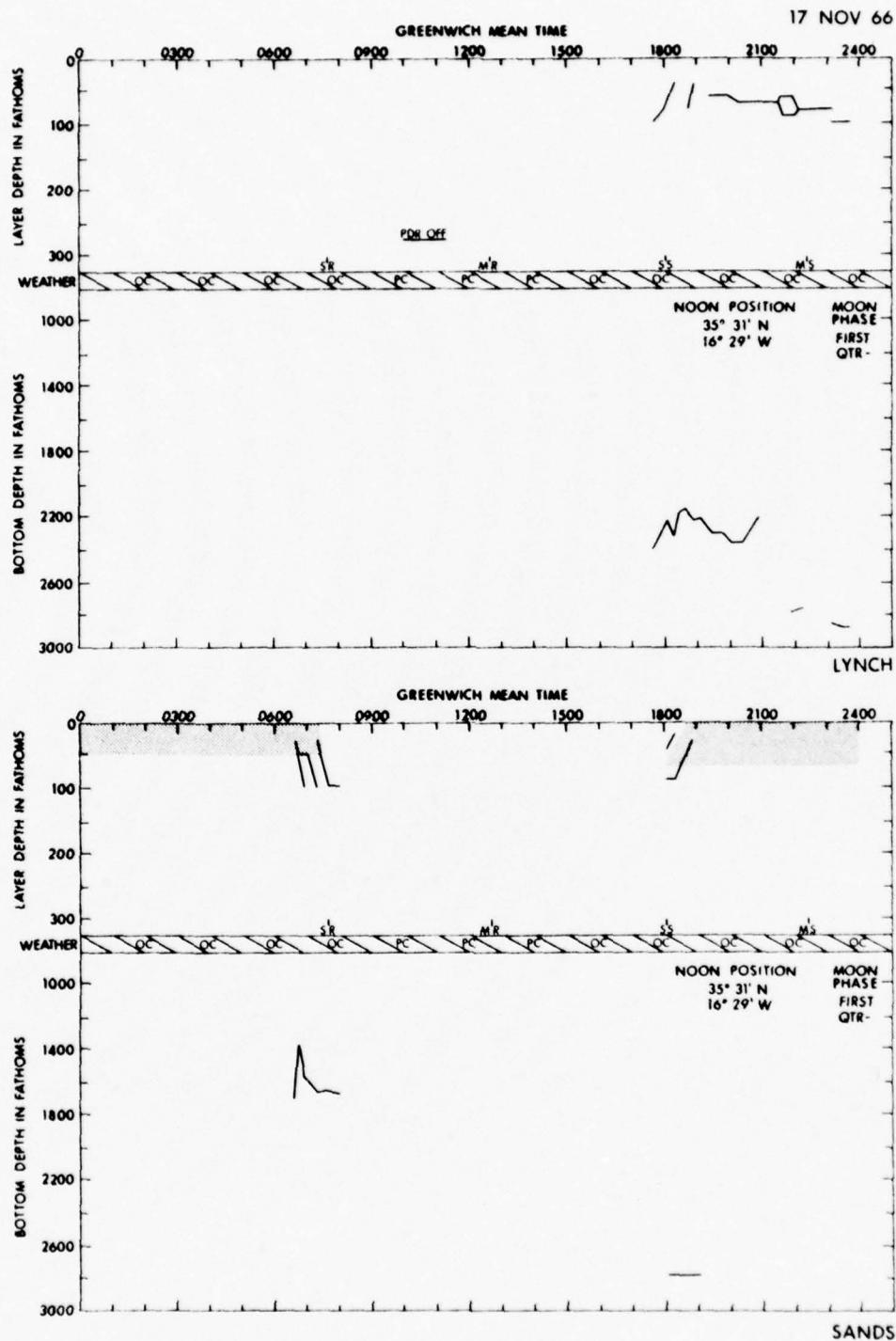


Fig. 17 - Daily Observations

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GREENWICH MEAN TIME

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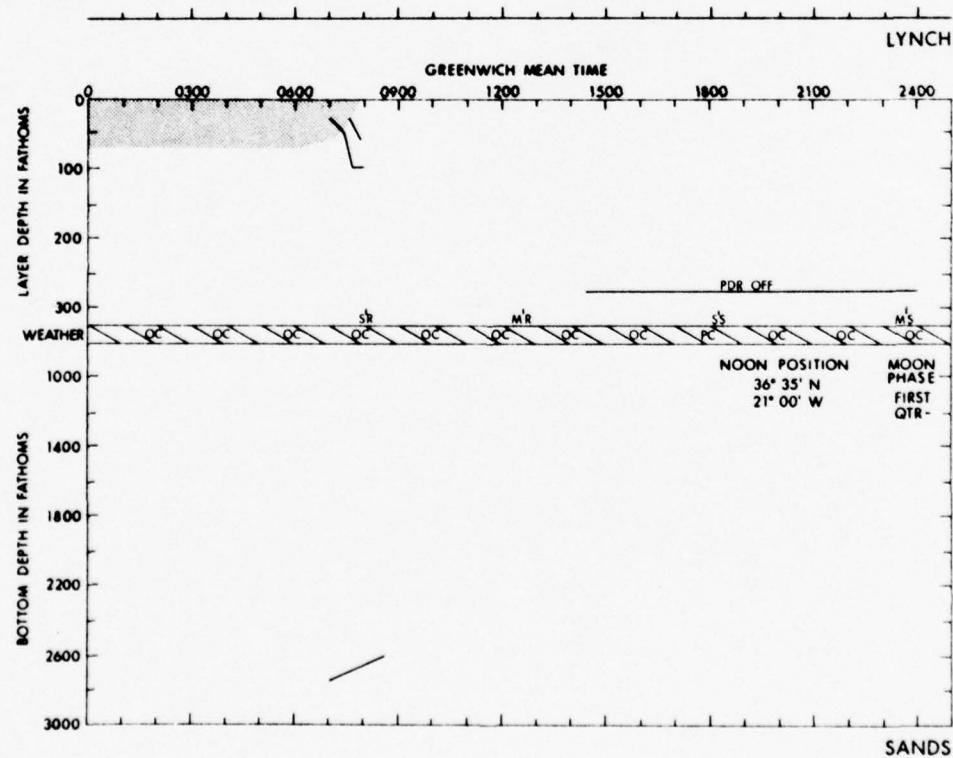


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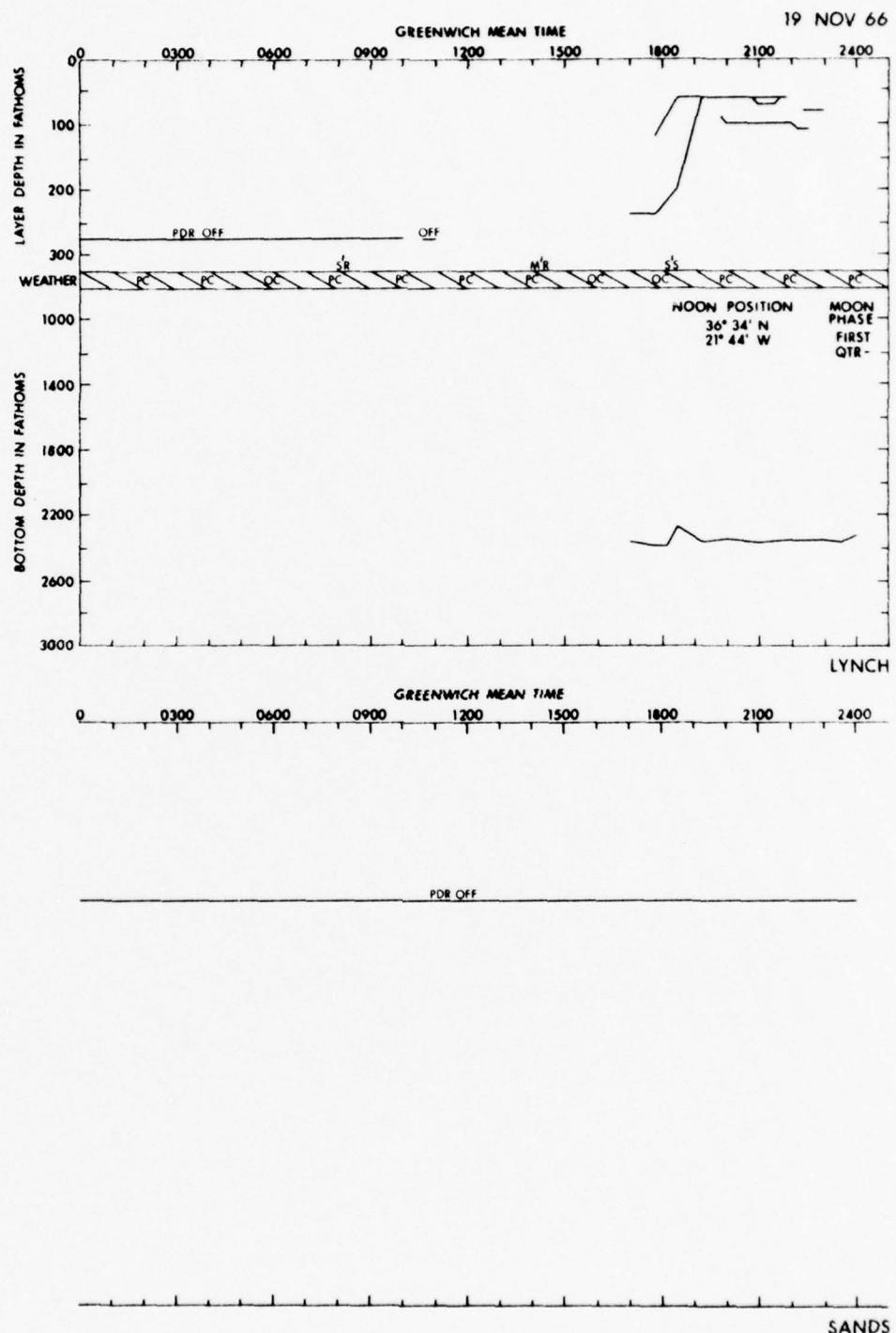


Fig. 19 - Daily Observations

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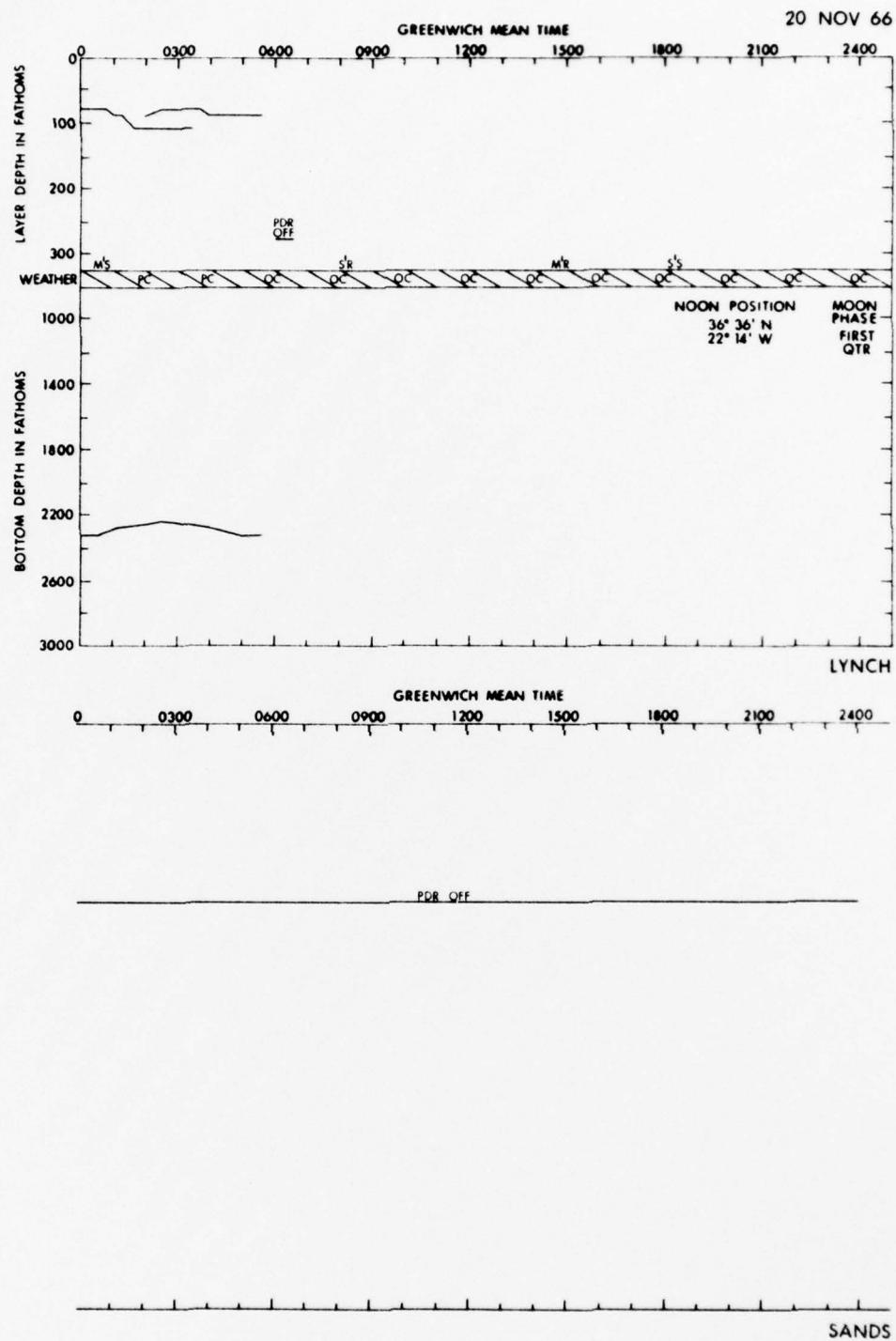


Fig. 20 - Daily Observations

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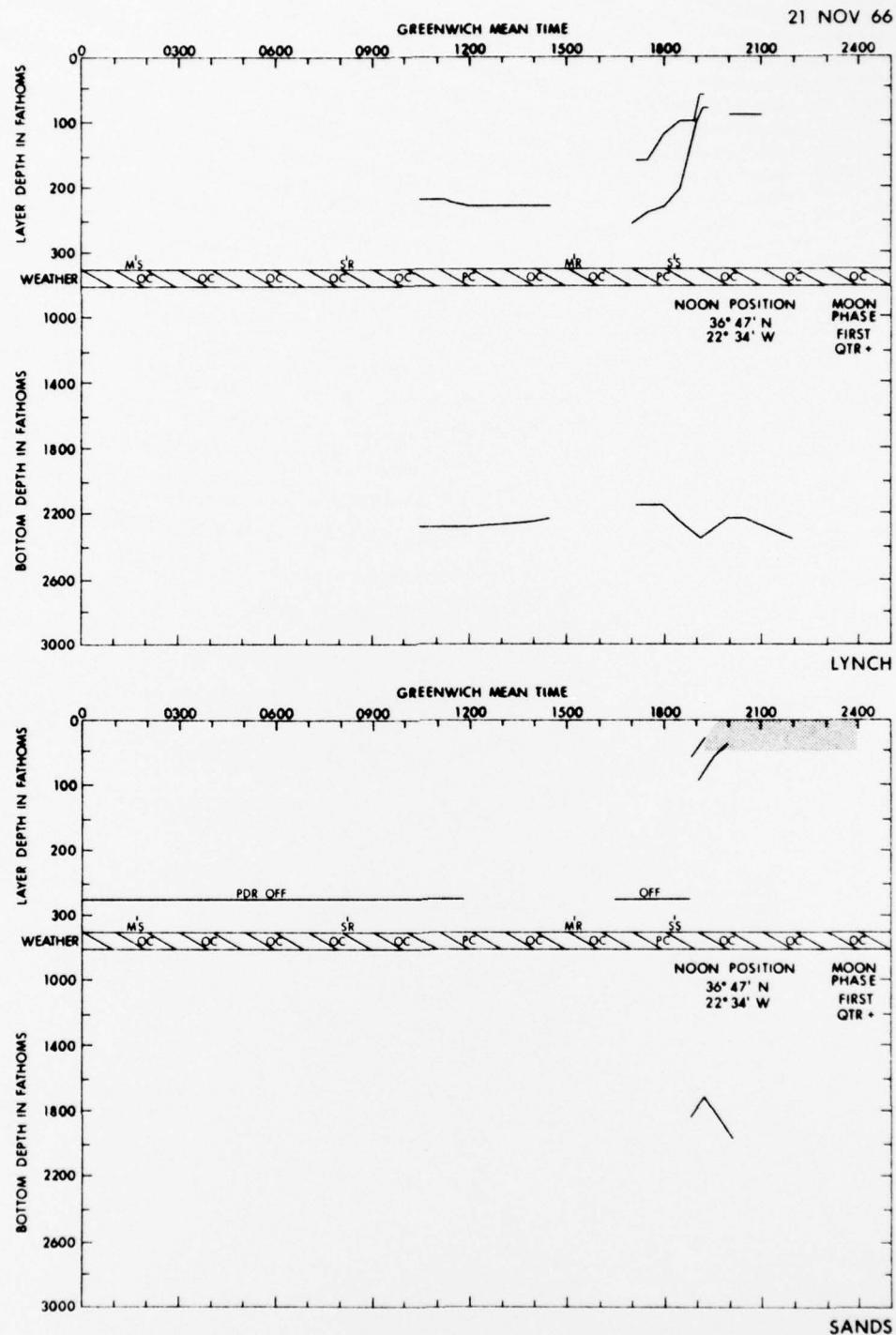


Fig. 21 - Daily Observations

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U.S. Navy Underwater Sound Laboratory
NP24-31555-10-67

Official Photograph

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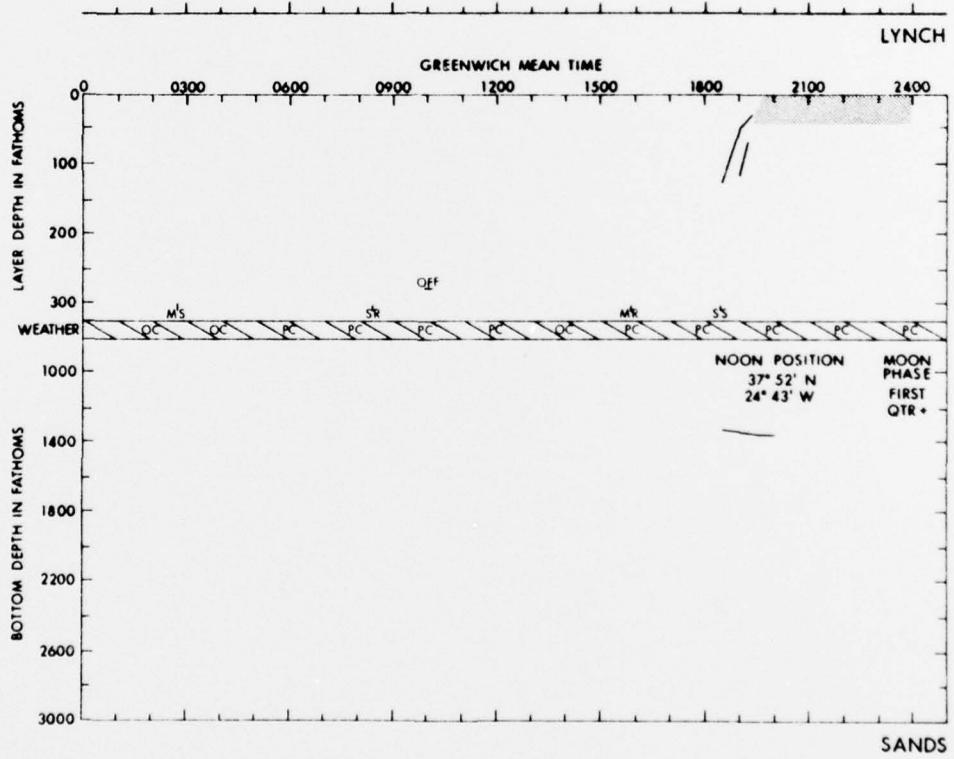
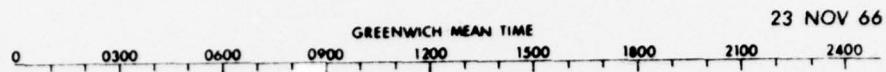


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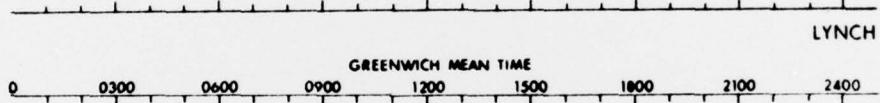
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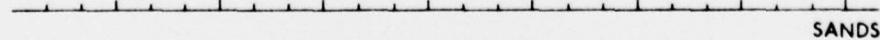


Fig. 23 - Daily Observations

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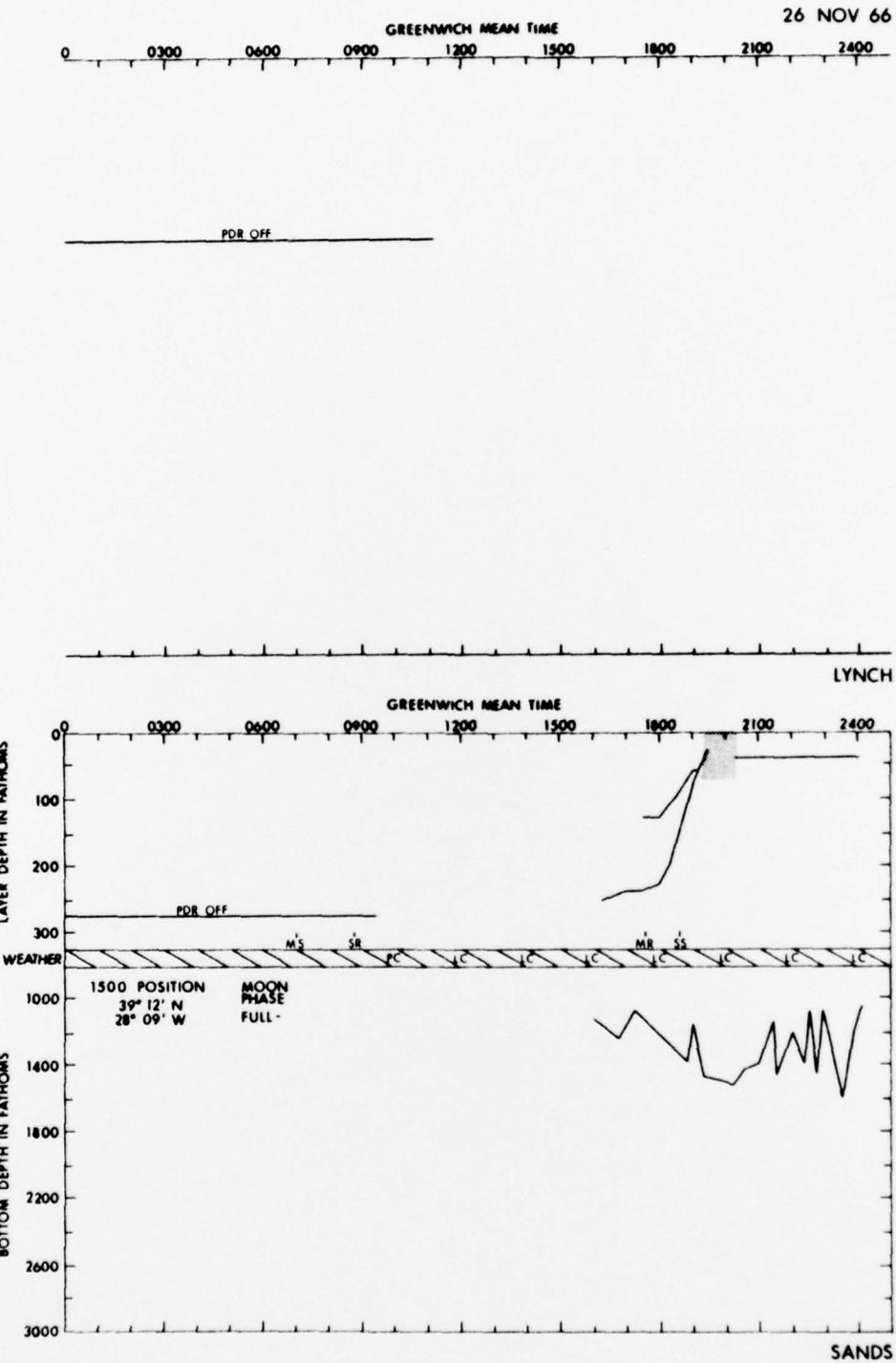


Fig. 24 - Daily Observations

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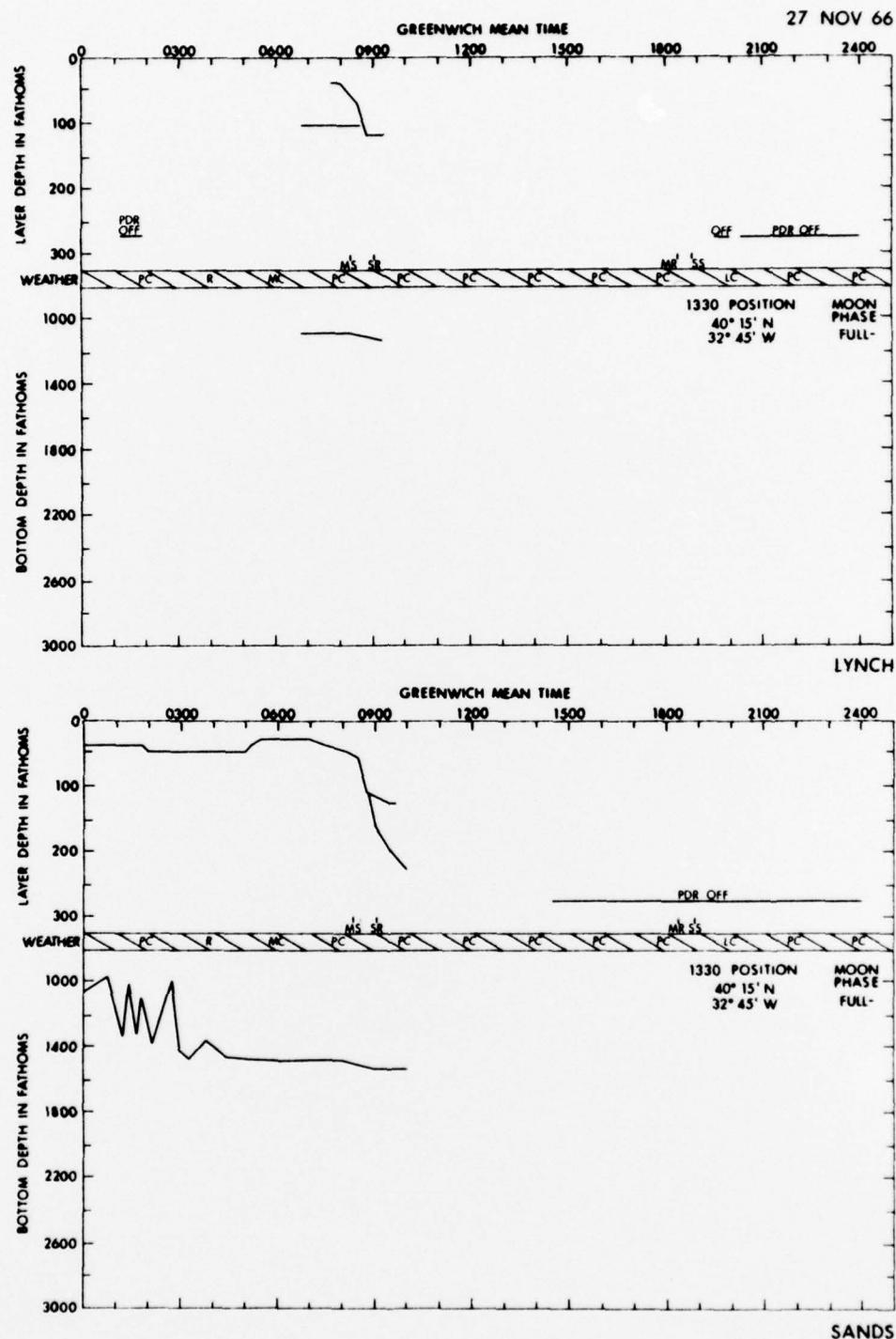


Fig. 25 - Daily Observations

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Official Photograph

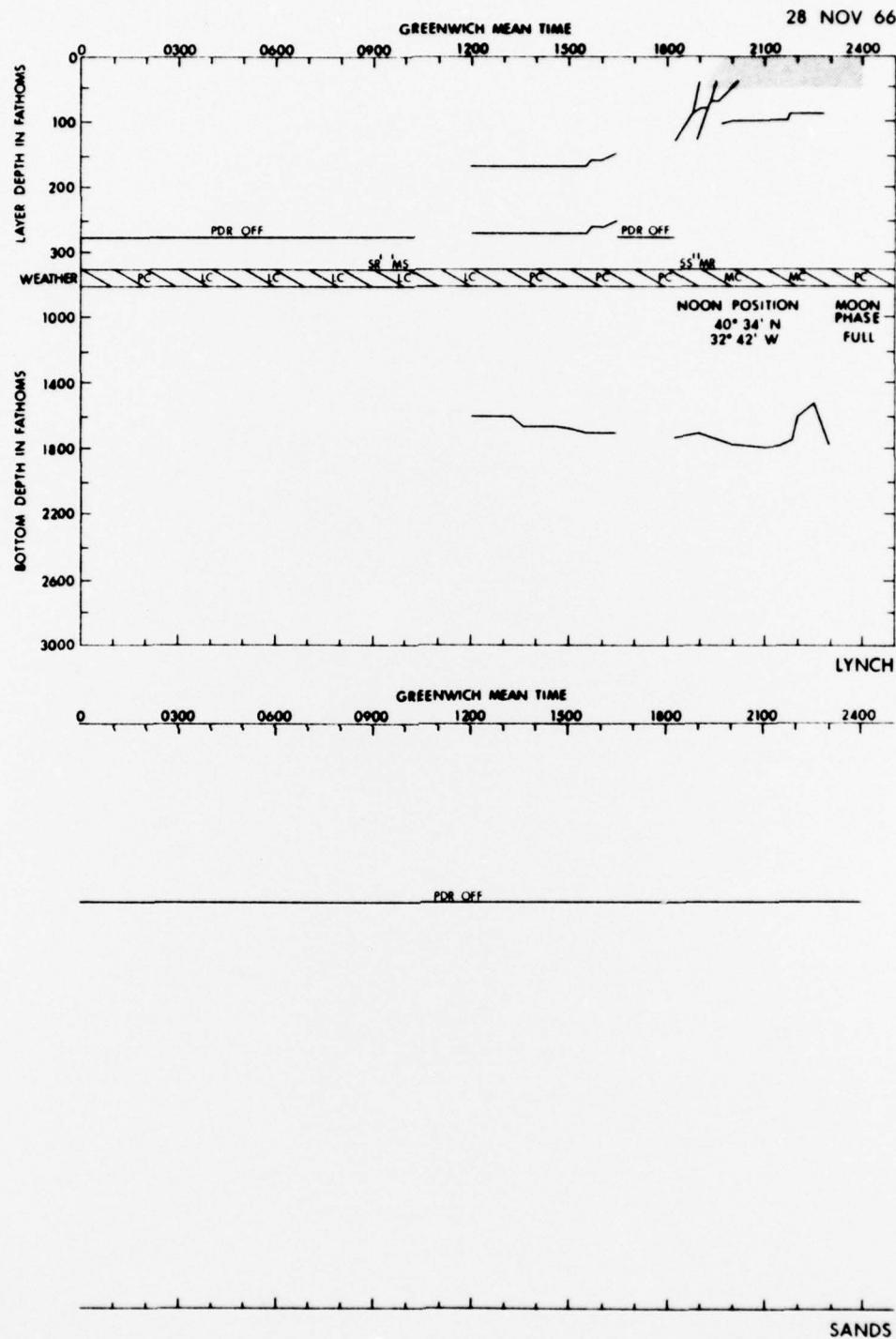


Fig. 26 - Daily Observations

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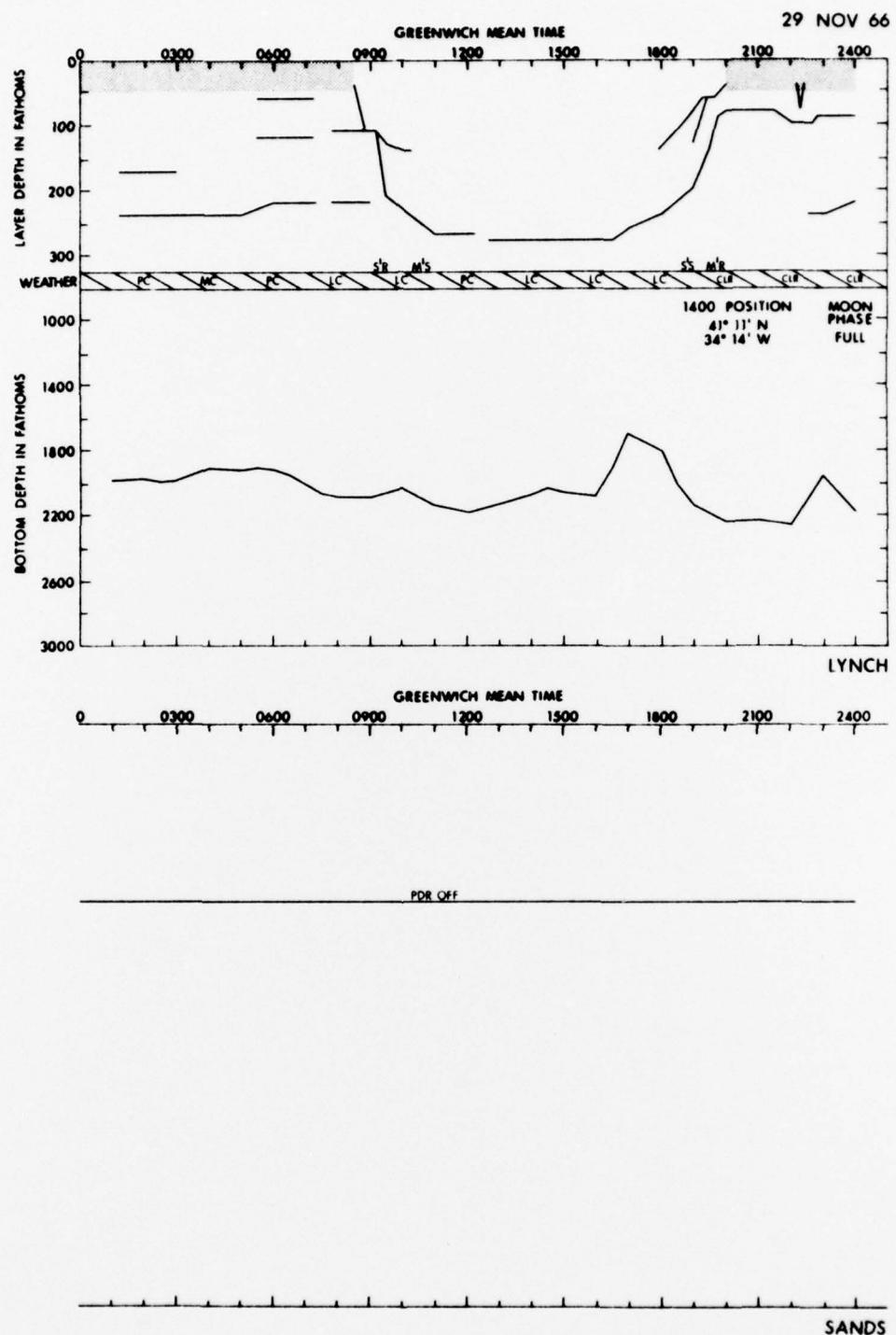


Fig. 27 - Daily Observations

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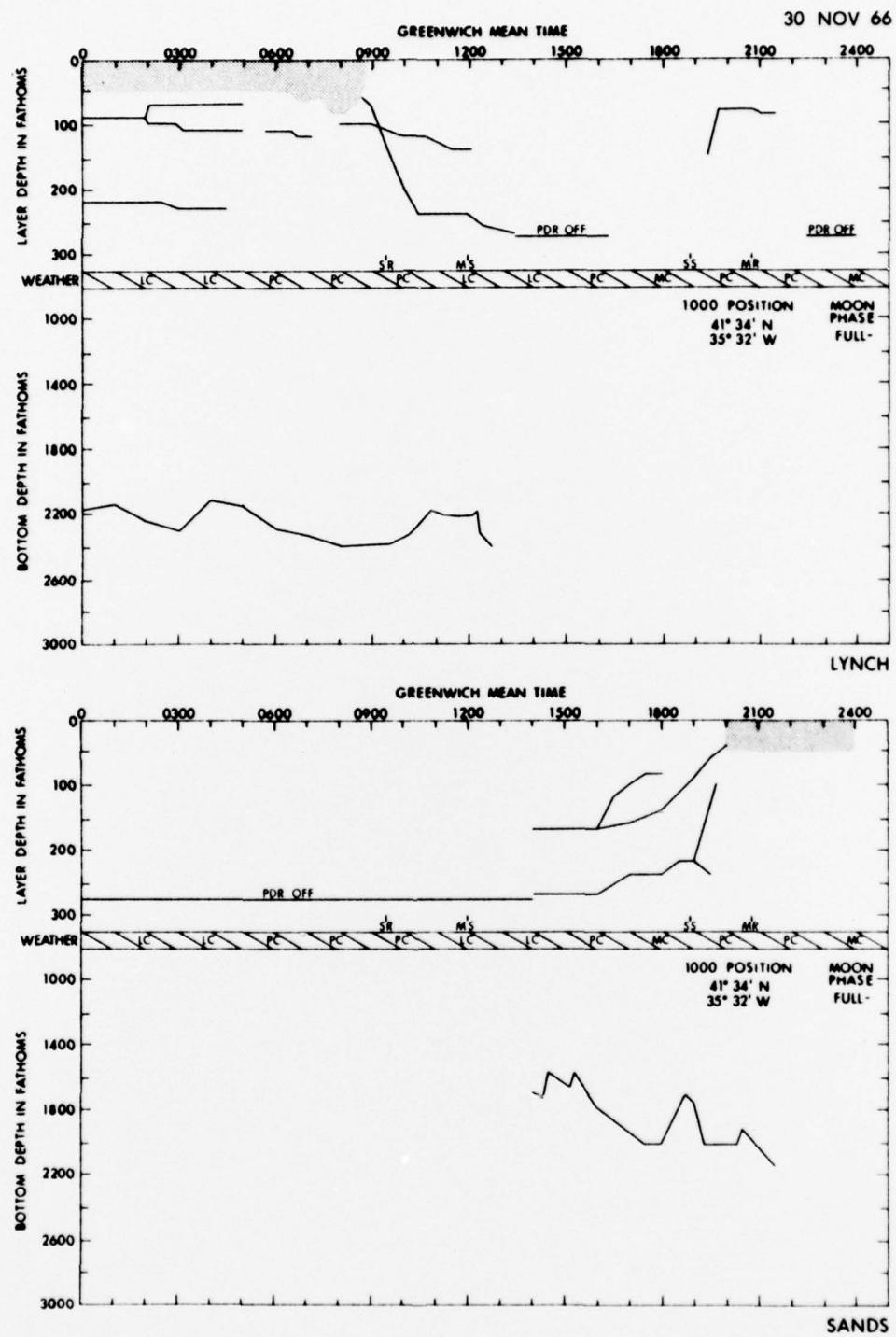


Fig. 28 - Daily Observations

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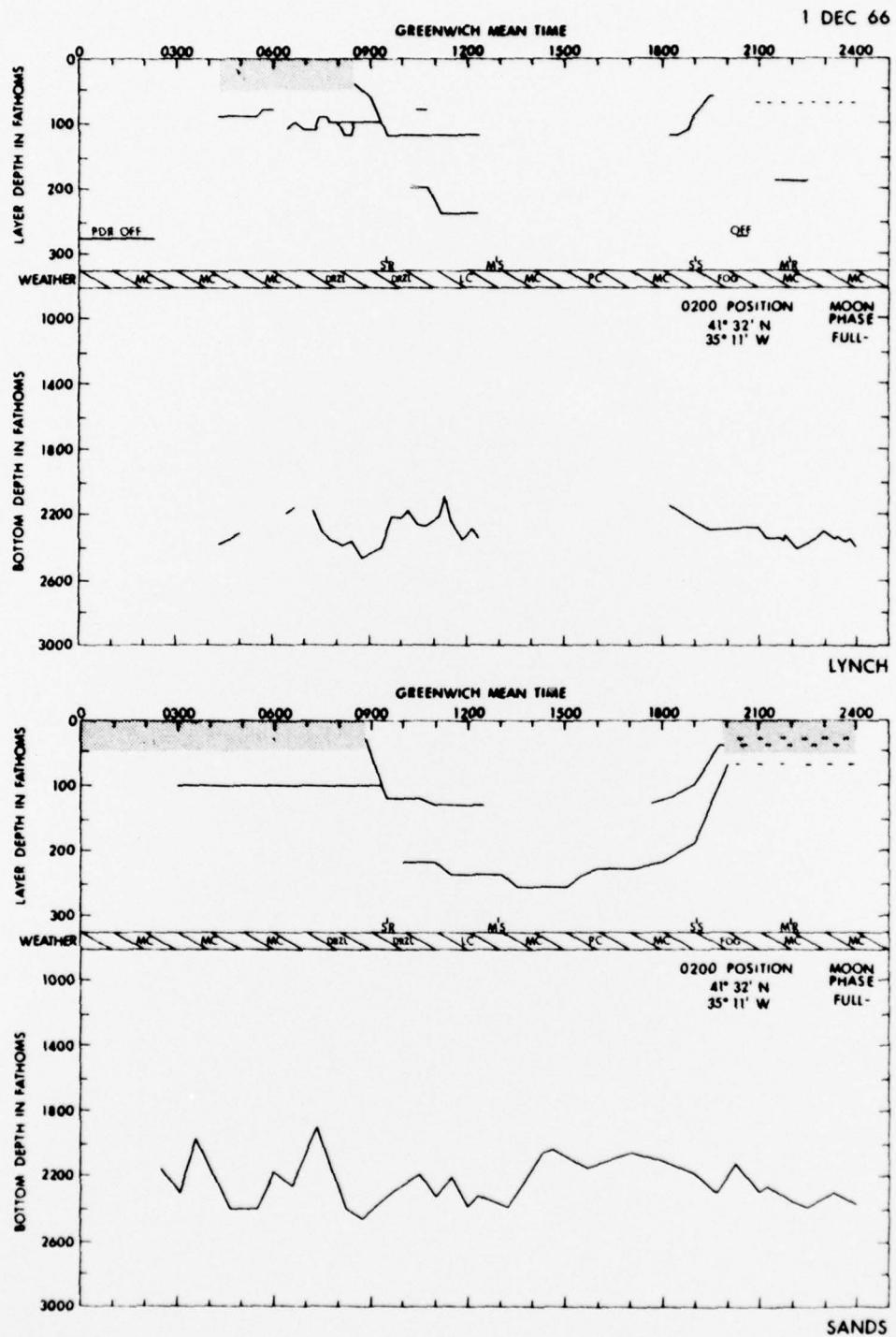


Fig. 29 - Daily Observations

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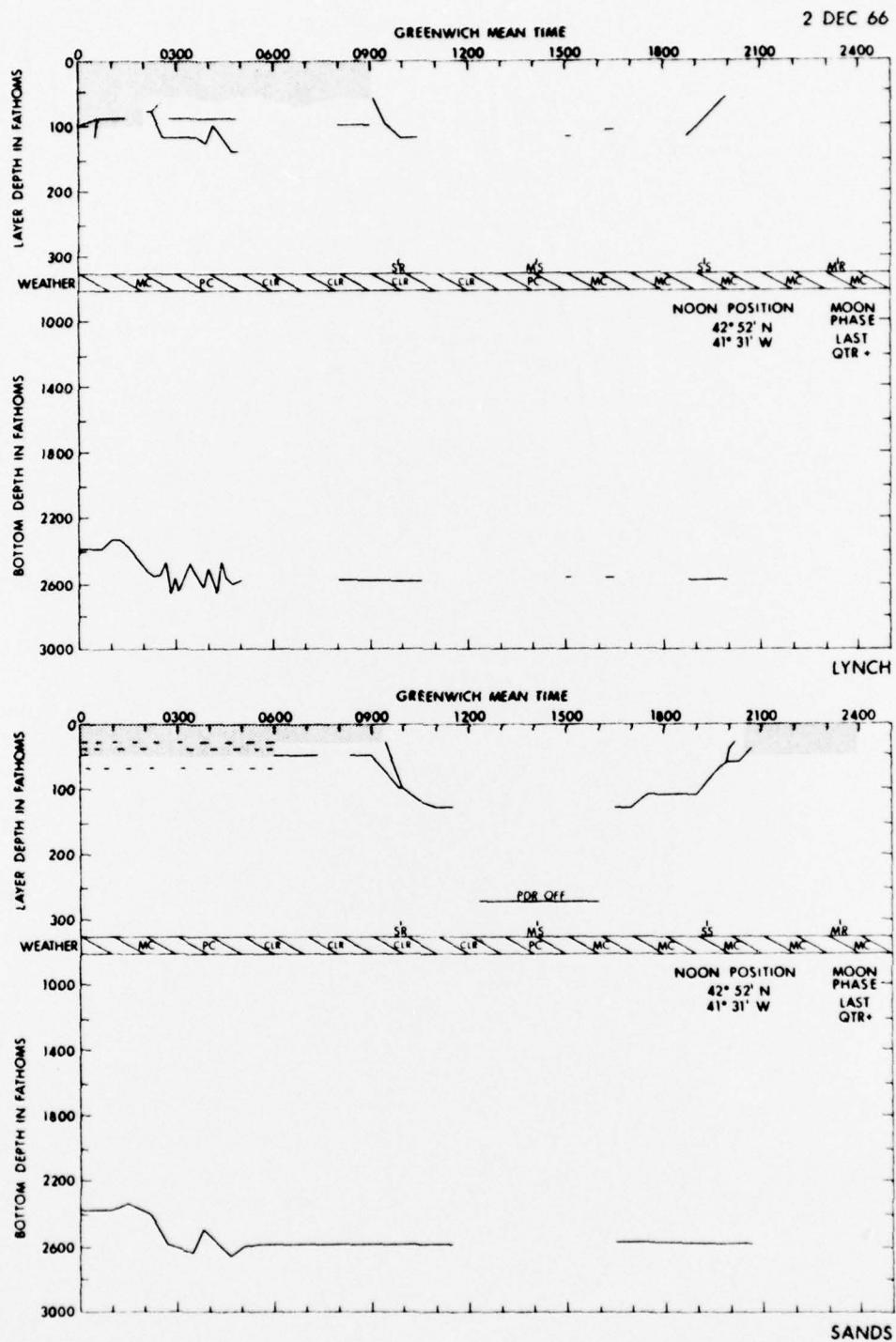


Fig. 30 - Daily Observations

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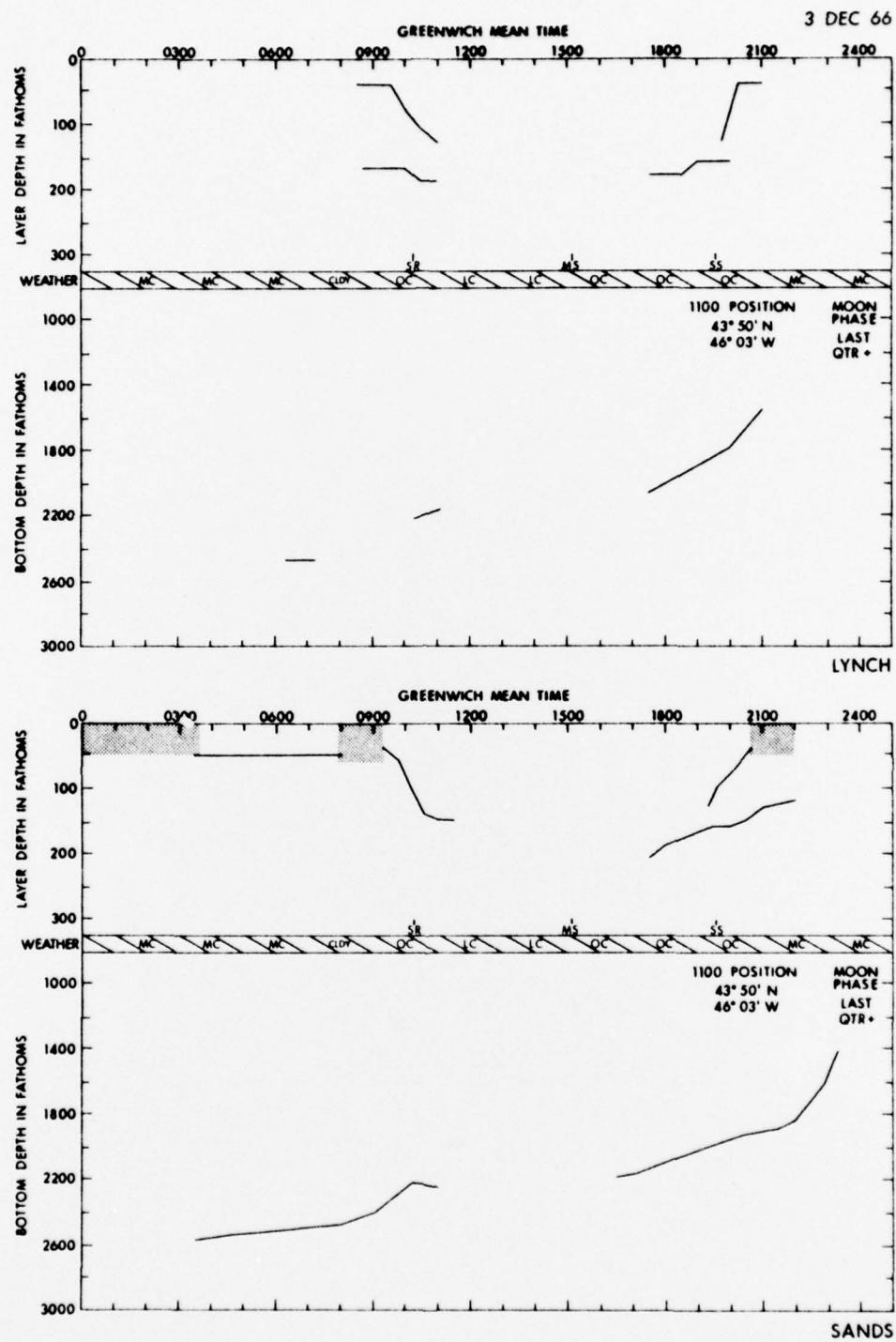


Fig. 31 - Daily Observations

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NP24 - 31565 - 10 - 67

Official Photograph

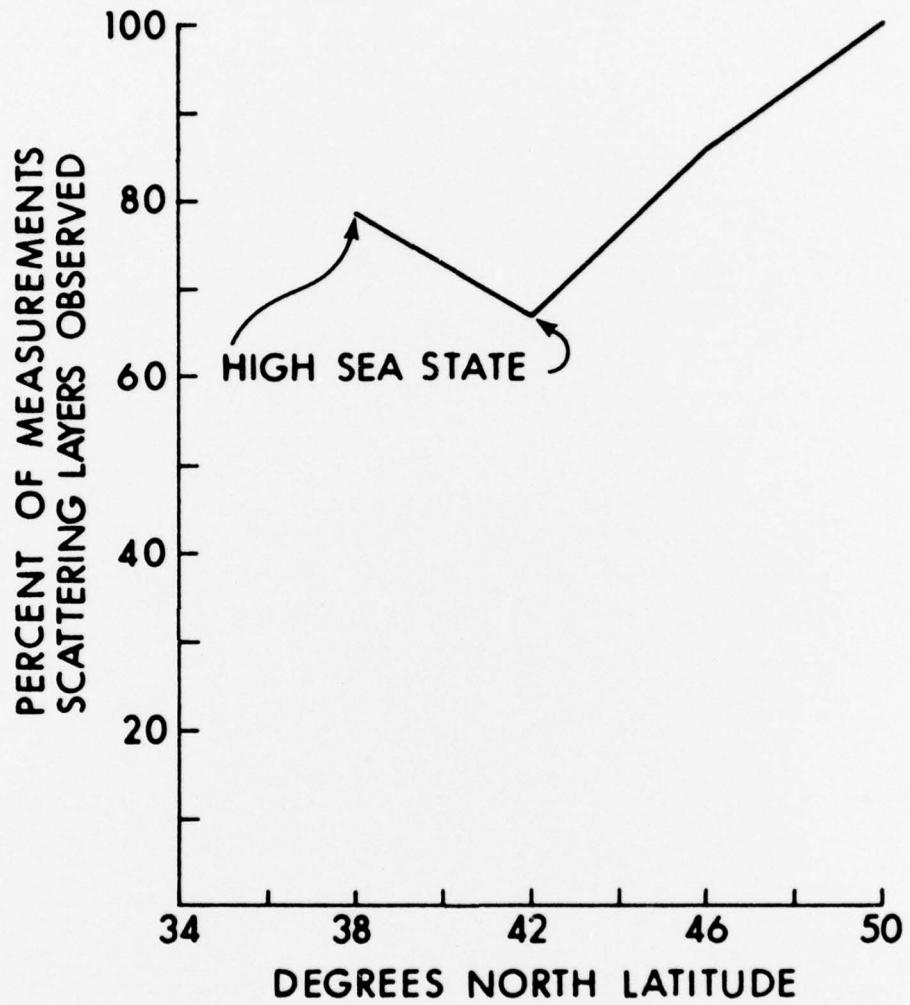


Fig. 32 - Percent of Scattering Layer Occurrence VS Latitude

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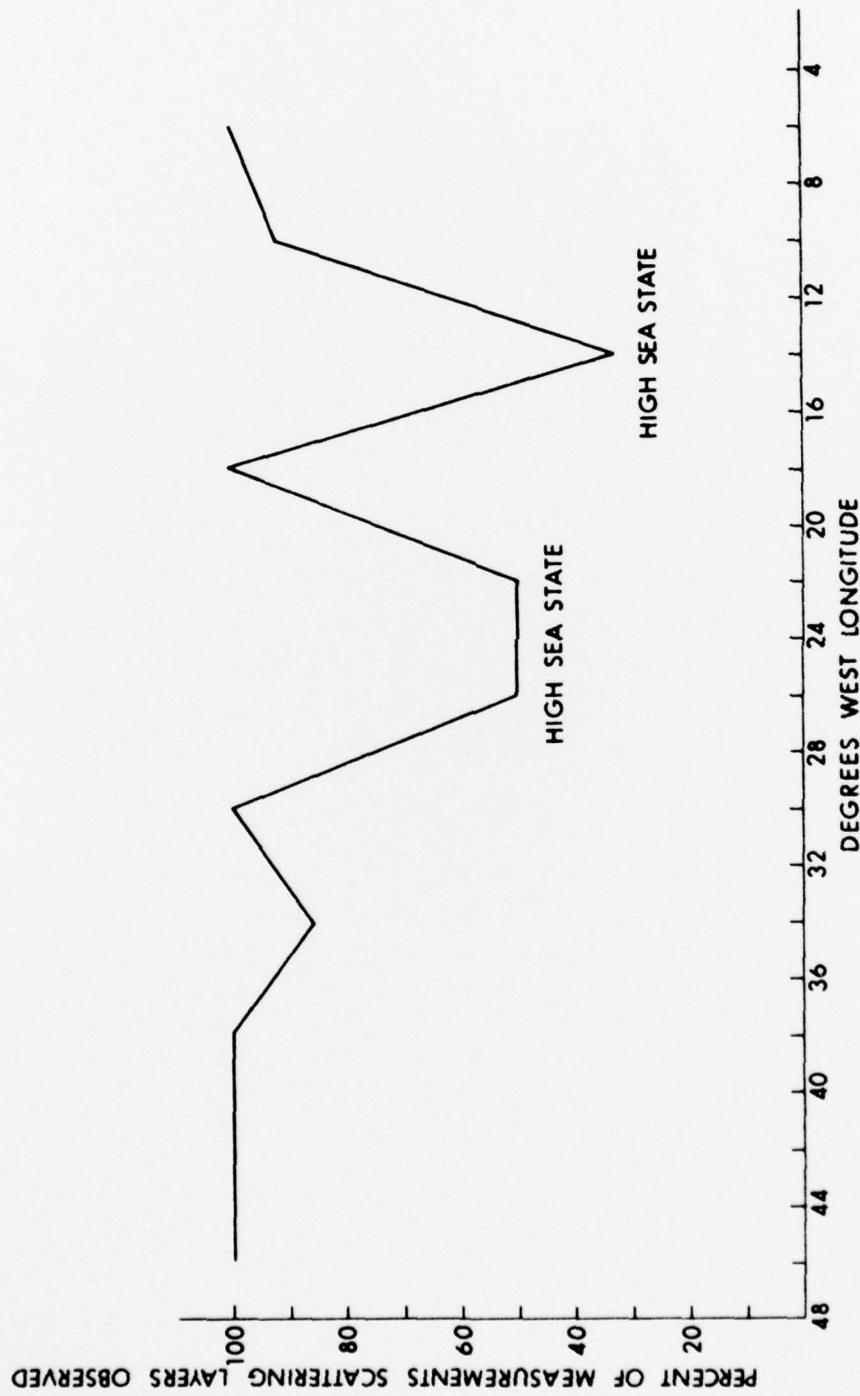


Fig. 33 - Percent of Scattering Layer Occurrence VS Longitude

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U. S. Navy Underwater Sound Laboratory
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Official Photograph

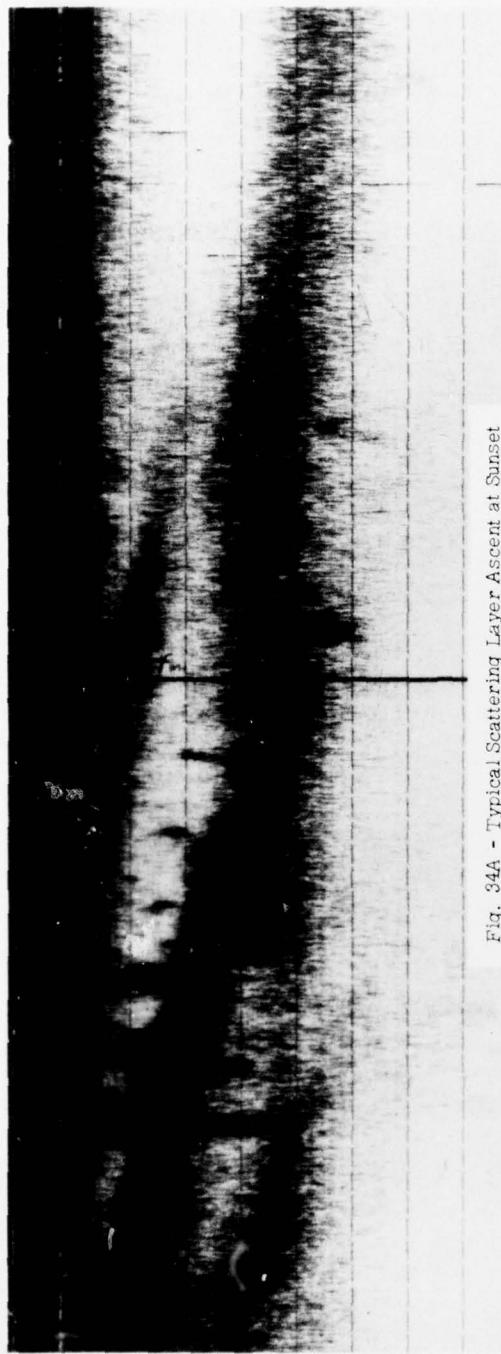


Fig. 34A - Typical Scattering Layer Ascent at Sunset

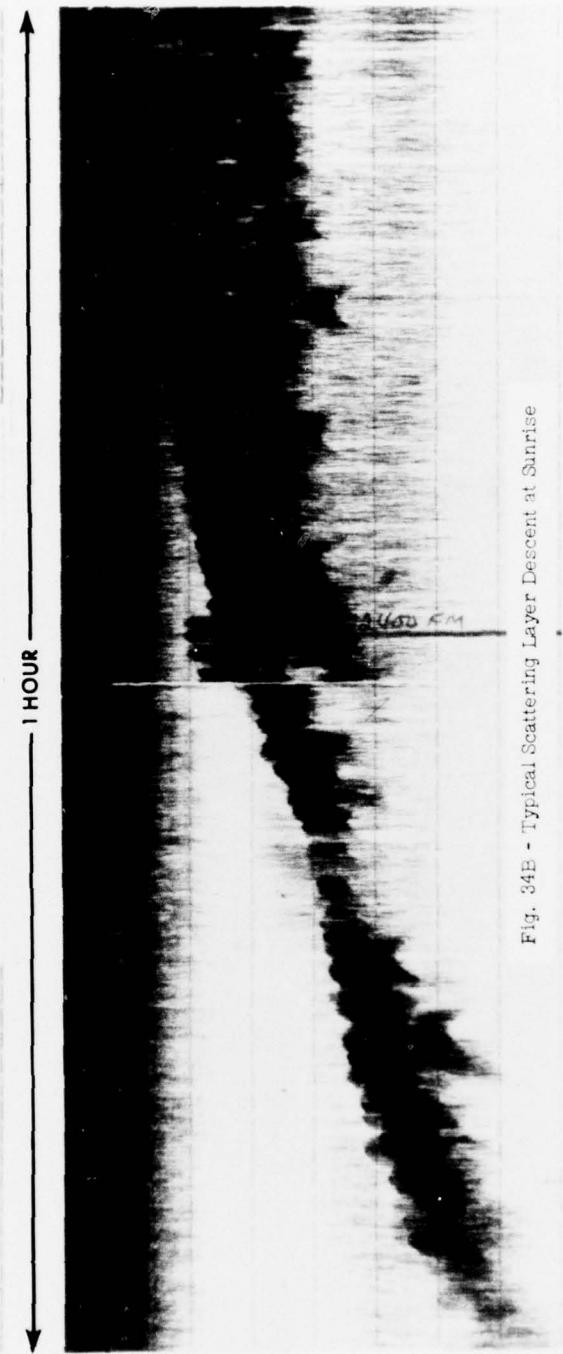


Fig. 34B - Typical Scattering Layer Descent at Sunrise

U. S. Navy Underwater Sound Laboratory
NP24 - 31709 - 10 - 67

Official Photograph